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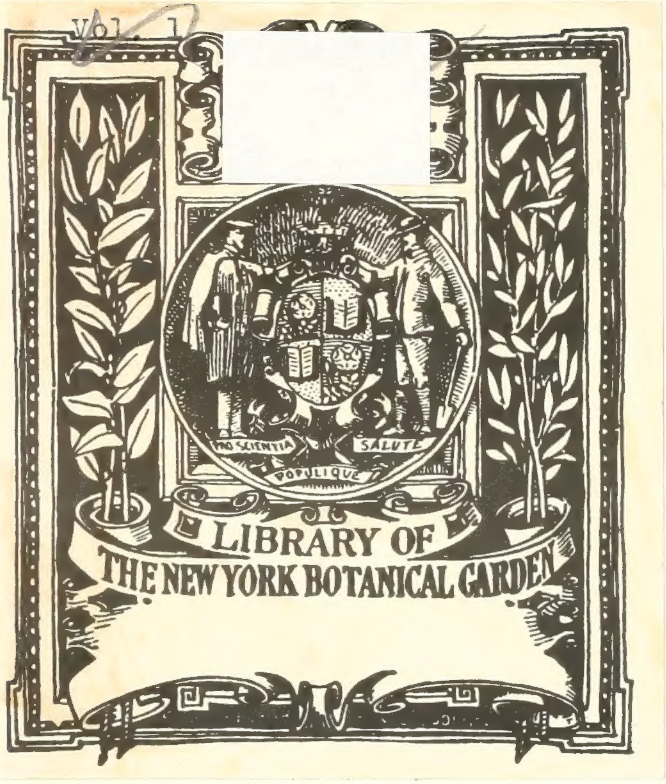
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VOL. 1

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THE NEW YORK BOTANICAL GARDEN

FLORA OF CALIFORNIA

JEPSON

1909

V. 1

BOTAN
GAR

GYMNOSPERMS

Resinous trees or shrubs, ours evergreen with linear, awl-like or scale-like leaves. Trunk usually persisting through the crown as a single axis, increasing in diameter by an annual layer of wood inside the bark. Sexual reproductive organs consisting of stamens and ovules. Stamens generally spirally arranged in a catkin-like cluster which falls after maturity. Ovules commonly borne naked on the surface of a scale with the scales arranged spirally in a short catkin which commonly matures into a woody cone. Cotyledons several to many, sometimes only 2.

Bibliog.—Endlicher, Stephano, Synopsis Coniferarum (1847). Carriere, E. A., Traite Coniferes (1855). Engelmann, Geo., Papers on Coniferæ (Collected Works, p. 326,—1887); Masters, M. T., The genera of Taxaceæ and Coniferæ (Jour. Linn. Soc. vol. 30, p. 1,—1893). Wordsell, W. C., Structure of the Female Flower in Coniferæ (Ann. Bot. vol. 14, p. 39,—1900). Veitch, James, et al., Manual of the Coniferæ (1900). Coulter & Chamberlain, Morphology of Gymnosperms (1901).

PINACEAE. Pine Family.

Trees or shrubs, typically with one main mast-like axis which bears laterally successive whorls of much-branched limbs. Leaves narrowly linear and alternate, or with bundles of needle-like leaves in the axils of scale-like (primary) leaves. Stamens and ovules in different catkins on same tree. Staminate catkins with numerous spirally arranged stamens, each bearing 2 pollen-sacs and ending in a roundish crest or mere knob; pollen-grains usually with 2 bladder-like appendages to assist distribution by the wind. Ovulate catkins with spirally arranged scales, each subtended by a distinct bract; ovules naked, 2 at the base of each scale on the upper side, maturing into seeds which commonly bear a wing derived from the surface tissue of the scale. Fruit a woody cone, the scales much enlarged, the bracts remaining small or sometimes elongated and surpassing the scale.—Northern hemisphere, eight genera. California has endemic representatives of all the genera except Cedrus (Lebanon Cedar and varieties), Larix (Larch) and Pseudolarix (of China).

Bibliog.—Don, David, Five New Species of the Genus Pinus discovered by Dr. Coulter in California (Trans. Linn. Soc. vol. 17, p. 439,—1837). Lemmon, J. G., Pines of the Pacific Slope (2d Rep. Cal. Board For. p. 67,—1888); Cone-bearers of California (3rd Rep. l. c. p. 79,—1890). Sargent, C. S., Silva N. Am. vol. 11 (1897), vol. 12 (1898). Masters, M. T., A General View of the Genus Pinus (Jour. Linn. Soc. vol. 35, p. 560,—1904).

Cones pendent or spreading, falling from the tree whole, the scales persistent.
  Leaves of 2 kinds, needle-leaves in fascicles of 1 to 5 and scale-leaves; cones maturing the second year, their bracts minute....................................1. Pinus.
  Leaves of 1 kind, linear; cones maturing in the first year, their bracts obvious.
    Bracts shorter than the scales; branchlets roughened by the persistent leaf bases.
      Leaves petioled, jointed on the woody base which is somewhat decurrent on the branchlet; trunk bark fissured or smoothish, not scaly.....2. Tsuga.
      Leaves sessile, jointed on the woody peg-like base which spreads at right angles to the branchlet; trunk bark marked by scars of deciduous scales..3. Picea.
    Bracts longer than the scales, notched at apex with a spear-like point in the notch; leaf-scars smooth; old bark very rough......................4. Pseudotsuga.
Cones erect on branch, maturing the first year, their scales falling separately; leaf-scars smooth. ....5. Abies.

1. PINUS L. Pine.

Trees with two sorts of leaves, the primary leaves thin and scaly or chaff-like, bearing in their axils needle-shaped leaves in fascicles of 1 to 5, which emerge from slender buds whose scarious scales sheathe the base of the cluster. Staminate catkins spreading, crowded in a whorl at the base of the shoot of the same spring. Ovulate catkins erect, lateral or sub-terminal, 1 to 8 in a whorl. Cones maturing in the second year, reflexed or pendulous, their scales woody, imbricated, the exposed portion (apophysis) often much thickened and bearing centrally an elevated scar or prickly boss (umbo). Cotyledons 4 to 17.—The genus Pinus, consisting of about seventy-five species distributed over the northern hemisphere and replaced in the southern hemisphere by the Araucarias and Podocarpums, is strongly represented in California, no other region relatively to area being so rich in species. (Pinus, the ancient Latin name.)

White Pines.—Cones subterminal, the apophysis of the cone-scale usually thin and unarmed; needles in 5s; wood light-colored, soft; chiefly high montane.

Cones long-stalked, very long and slender when closed.

Needles 1 to 3¾ inches long; cones 6 to 8 inches long; high ranges..1. *P. monticola.*

Needles 2 to 3½ inches long; cones 13 to 18 inches long; high ranges.2. *P. lambertiana.*

Cones with short stalks or almost none; needles 1 to 2½ inches long.

Scales very thick at tip, not closely overlapping; cones subglobose, 1 to 3 inches long; high montane ....3. *P. albicaulis.*

Scale-tips slightly thickened, rather closely overlapping; cones commonly long-ovate, 2 to 5 inches long; desert mountains chiefly...................4. *P. flexilis.*

Yellow Pines.—Cones subterminal, sessile or nearly so, the scales with a thick apophysis which is umbonate and armed with a prickle; needles in 5s, 3s, or 2s; wood very pitchy.

Needles in 5s.

Cones oblong-ovate, 2½ to 5 inches long; scales with minute prickles; needles ¾ to 1 inch long; Mt. Whitney region and high North Coast Ranges..5. *P. balfouriana.*

Cones slender ovate, 3 to 3½ inches long; scales with long slender prickles; needles 1 to 1½ inches long; desert ranges..........................6. *P. aristata.*

Needles in 3s, 5 to 10 inches long; cones breaking through near base when falling, some scales remaining on branch.

Cones ovate, 3 to 5 inches long; common at middle altitudes......7. *P. ponderosa.*

Cones round-oval, 5 to 10 inches long; at higher altitudes............Var. *jeffreyi.*

Needles in 2s, 1¼ to 2¾ inches long.

Bark thin, smooth; high montane...........................8. *P. murrayana.*

Bark thick, rough; seashore.................................9. *P. contorta.*

Nut Pines.—Cones lateral or subterminal, the scales strongly thickened at tip or prolonged into conspicuous spurs or hooks; seeds large, thick shelled, the wing short or none; needles 1 to 5 in a cluster; arid areas and chiefly low altitudes.

Cones very large, with highly developed spurs, breaking through near base when falling, a few lower scales persisting on the branch; needles in 3s.

Cones ovate, 10 to 13 inches long; needles erect, 5 to 14 inches long; trunk persisting through crown as one main axis; foliage yellowish; South Coast Ranges and Southern California......................................10. *P. coulteri.*

Cones round-oval, 6 to 10 inches long; needles drooping, 7 to 13½ inches long; trunk branching into several secondary axes; foliage gray; dry interior foothills. ....11. *P. sabiniana.*

Cones with pyramidal apophyses.

Needles in 5s, 8 to 12 inches long; cones triangular-oval, 4 to 5½ inches long; scales with pyramidal apophyses; local on south coast.............12. *P. torreyana.*

Needles commonly in 4s, 1 to 1½ inches long; cones subglobose, ¾ to 1½ inches long; Southern and Lower California............................13. *P. parryana.*

Needles 1 in a place, 1½ to 2 inches long; cones subglobose, 2½ to 3½ inches long; desert region ....14. *P. monophylla.*

Closed-cone Pines.—Cones lateral, sessile, one-sided, opening tardily, often remaining closed for many years, their scales conspicuously swollen at tip; needles in 3s or 2s; lower altitudes, chiefly of coast.

Needles in 2s, 4 to 6 inches long; cones ovate, 2 to 3 inches long, often developing stout spurs; seashore ....15. *P. muricata.*

Needles in 3s.
  Cones broadly ovoid, 2½ to 4½ inches long; needles 3 to 6 inches long; seashore. ....16. *P. radiata.*
  Cones oblong-ovate, 3 to 6 inches long; needles 3 to 5 inches long; montane....... ....17. *P. tuberculata.*

1. **P. monticola** Don. Silver Pine. Forest tree, 50 to 175 feet high, the branches slender and spreading or somewhat drooping and mostly confined to the upper portion of the shaft; trunk 1 to 6 feet in diameter, clothed with a very smooth though slightly checked whitish or reddish bark ½ to 1¼ inches thick; needles in 5s, very slender, 1 to 3¾ inches long, sheathed at base by thinnish narrow deciduous scales, some of which are 1 inch long; staminate catkins 3 or 4 lines long, 6 or 7 (or more) in a cluster; ovulate catkins borne near the ends of high branches on long peduncles; cones pendulous, 6 to 8, or rarely 10 inches long, very slender when closed and usually curved towards the tip, black-purple or green when young, 2½ to 3½ inches broad near the base when open and tapering to the apex; scales thin, smooth, widening from the base to the rounded apex, chocolate-brown except the apophysis, which is buff and bears a terminal scar-like umbo; seeds 3 to 4 lines long, their wings about 3 times as long, widest at the middle; cotyledons 5 to 9, mostly 7 or 8.

Sierra Nevada, in the main timber belt from 6,000 to 9,000 feet, ranging west to Mt. Shasta, Scott Mts., the Trinities and Siskiyous, and northward to Vancouver Island and northwestern Montana. Its wood is valuable but the species is too weakly represented to be of very great forestral importance.

Refs.—Pinus monticola Don in Lambert, Pinus, vol. 3, p. 27 (1837), type loc. mountains near Grand Rapids of the Columbia, *Douglas;* Sargent, Gard. & For. vol. 5, p. 1, fig. 1 (1892); Merriam, Biol. Sur. Mt. Shasta, pp. 39, 136 (1899).

2. **P. lambertiana** Dougl. Sugar Pine. (Fig. 3.) Forest tree 80 to 250 feet high, the young and adult trees symmetrical, but the aged trees commonly with broken summits or characteristically flat-topped with 1 or 2 long arm-like branches exceeding shorter ones; trunk 2 to 8 feet in diameter, its bark brown or reddish, closely fissured into rough ridges scaly on the surface, 1 to 4 inches thick; needles in 5s, slender, 2 to 3½ inches long; staminate catkins yellowish brown, 3 to 4 lines long, 15 to 25 in a cluster, their pollen-sacs with broad or roundish minutely erose crests; cones pendulous on peduncles (2 to 3½ inches long) at the ends of branches, mostly in the very summit of the tree, very long oblong, 13 to 18 inches long, 4 to 6 inches in diameter when opened; scales broad, only very slightly thickened, rounded at apex and tipped with a terminal scar-like umbo; seeds 4 to 7 lines long with wings twice as long and broadest near the middle; cotyledons 13 to 15.

Sierra Nevada, mainly between 4,000 and 6,500 feet, the fourth most abundant species in the main timber belt. North Coast Ranges: isolated patches on Galloway and Austin creeks in Sonoma Co.; Oathill Mine, Mt. St. Helena, Cobb Mt., Sanhedrin, Bartlett Mt. and north along the Yollo Bollys to South Fork Mt., Trinity Summit, Marble Mt. and Mt. Shasta, thence north into Oregon as far as North Fork Santiam River. South Coast Ranges: reported west of Palo Alto; Santa Lucia and Twin Peaks in Santa Lucia Mts.; San Rafael Mts., eastward to Tehachapi and southward through all the high Southern California ranges (5,000 to 10,000 feet on the Sierra Madre, San Bernardino, San Jacinto and Cuyamaca mts.); Lower California. Associated with Yellow Pine, Incense

Cedar and White Fir. The largest of all pines. Wood light, soft, straight-grained, of high commercial value.

Refs.—Pinus lambertiana Douglas, Trans. Linn. Soc. vol. 15, p. 500 (1827), type loc. Umpqua River Mts., Oregon, *Douglas;* Comp. Bot. Mag., vol. 2, pp. 92, 106, 107, 130, 152 (1836); Sudworth, 21st Rep. U. S. Geol. Sur. pt. 5 (For. Res.), p. 522 (1900); Jepson, Fl. W. Mid. Cal. p. 20 (1901). Sugar Pine, Cooper, For. Service Bull. no. 69 (1906).

3. **P. albicaulis** Engelm. White-bark Pine. (Fig. 1.) Subalpine tree, usually dwarfish or prostrate; trunk ½ to 2 feet in diameter, often with 2 or 3 main stems from the base, 2 to 40 feet high; bark thin, whitish and smooth, or fissured into scaly plates on the main trunk; needles in 5s, 1 to 2½ inches long, persisting 5 to 7 years, densely clothing the tips of the slowly growing branchlets; catkins scarlet; cones ovoid or subglobose, yellowish brown, 1 to 3 inches long and nearly as thick; scales broad and rounded at apex with a short acute umbo, not overlapping closely but their tips strongly thickened and either projecting freely or presenting very bluntish points; seeds obovate, acute, not compressed or only on one side, obscurely margined towards the point, ⅓ to ½ inch long; wing narrow, usually persistent on the scale; cotyledons 7 to 9.

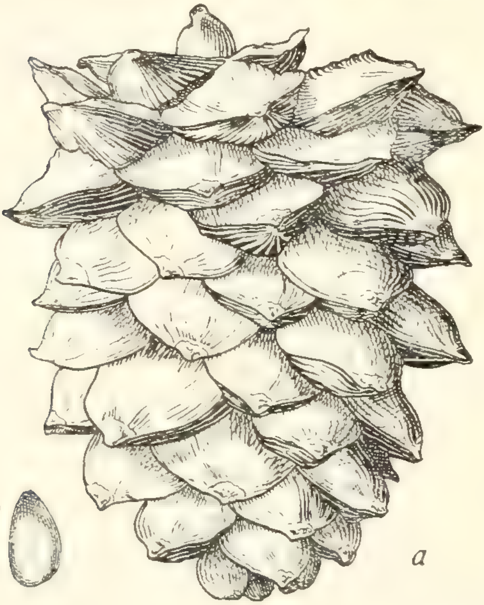

Fig. 1. Pinus albicaulis Engelm. *a*, Closed cone; *b*, seed. nat. size.

Subalpine on the Sierra Nevada, southward to the San Bernardino Mts., north to British Columbia and easterly to the Rocky Mts. In the Coast Ranges it occurs on a few high peaks (Salmon Mts., Marble Mt.). In the Sierra Nevada it is a timber line tree, between 8,000 and 10,000 feet in the south and 6,000 to 8,000 feet in the north, forming a very thin and scattered scrubby growth on exposed slopes. Where winter snows accumulate to great depth on plateaus or in cirques it occurs as low trees only 2 or 3 feet high but with a flat or table-like top 6 to 10 feet broad.

Refs.—Pinus albicaulis Engelmann, Trans. St. Louis Acad. vol. 2, p. 209 (1863), type loc. Oregon Cascades, *Newberry;* Merriam, Biol. Sur. Mt. Shasta, pp. 39, 137 (1899). *P. flexilis* var. *albicaulis* Engelmann in Bot. Cal. vol. 2, p. 124 (1880).

4. **P. flexilis** James. Limber Pine. Tree 10 to 60 feet high with a short trunk 1 to 3 feet in diameter; needles in 5s, 1 to 2¼ inches long, often curving, densely clothing the ends of the branchlets and forming a sort of brush; catkins reddish; cones buff or olive-buff, globose to long-ovate, 2 to 5 inches long; scales broad with rounded slightly thickened tips and terminal scar-like umbo, overlapping rather closely and leaving only a narrow portion free on the upper side the scale; seeds nearly oval, markedly compressed, surrounded by an acute margin, 4 or 5 lines long; wing narrow, generally persistent on scale; cotyledons 6 to 9.

Subalpine, 7,000 to 12,000 feet: east slope of Sierra Nevada from Mono Pass south to Monache Peak, attributed to west slope on high ridges south side of South Fork Kings River; Panamint Range; Mt. Pinos (Ventura Co.); Sierra Madre and San Bernardino mts.; San Jacinto Mts. (W.L.J. no. 2308); El Toro Peak. Ranges far east to Rocky Mts. of New Mexico and north to Alberta.

Refs.—Pinus flexilis James, Long's Exped. vol. 2, p. 35 (1823); Coville, Bot. Death Val. p. 221 (1893).

5. **P. balfouriana** Jeffrey. Foxtail Pine. Subalpine tree, 20 to 45 feet high, with cone-shaped trunk 1 to 4 feet in diameter at the base, the axis in old or in storm-beaten trees at timber line projecting through the crown as a dead and shining splinter point; trunk bark reddish brown, smoothish but superficially checked; branches stout and rather short with half-drooping branchlets thickly clothed with short needles persisting 10 to 15 years and thus resembling a fox's tail; needles in 5s, bright green on the upper side, glaucous on the lower, ¾ to 1 inch long; cones slender when closed, oblong-ovate in outline when open, terra-cotta color, 2½ to 5 inches long, 1¾ to 2 inches broad; tips of the scales thickened or low-pyramidal, with shrunken scar-like umbo; seeds 3½ to 4 lines long, their wings narrow, 6 to 11 lines long; cotyledons 5.

Timber line tree local in two widely separated areas: North Coast Ranges from South Yollo Bolly north to the Scott Mts. and Marble Mt.; southern Sierra Nevada from Olanche Peak northward over the Whitney Plateau to Bubbs Creek and South Fork San Joaquin, and westward to the Chagoopah Plateau and Alta Peaks.

Refs.—Pinus balfouriana Jeffrey, Oreg. Exped. 1, t. 3, fig. 1 (1853), type loc. Scott Mts., *John Jeffrey*; Lemmon, 2d Rep. Cal. Board For. pp. 71, 86, t. 5 (1888); Jepson, Sierra Club Bull. vol. 4, p. 214, pl. 75 (1903).

6. **P. aristata** Engelm. Hickory Pine. Bushy tree 15 to 40 feet high; leaves 1 to 1½ inches long; young bark milky white; cones slender ovate, 3 to 3½ inches long, the scales armed with slender prickles 3 lines long.

High mountains of Nevada, northern Arizona and New Mexico, east to central Colorado and westward to the Death Valley region of California where it is found on the Funeral, Grapevine, Charleston and Panamint ranges between 7,500 and 11,000 feet. Wood of poor quality but on account of timber scarcity it is lumbered in central Nevada where it is known as "White Pine."

Refs.—Pinus aristata Engelmann, Am. Jour. Sci. ser. 2, vol. 34, p. 331 (1862); Sargent, Silva, vol. 11, p. 63, t. 554 (1897). *P. balfouriana*, var. *aristata* Engelmann, in Bot. Cal. vol. 2, p. 125 (1880).

7. **P. ponderosa** Dougl. Yellow Pine. (Fig. 2.) Forest tree 60 to 225 feet high, the trunk 2 to 9 feet in diameter and often clear of branches for 40 to 100 feet; branches horizontal or drooping; trunk bark in typical trees tawny yellow, divided by fissures into large scaly-surfaced plates 1 to 4 feet long and ½ to 1¼ feet wide; needles in 3s, 5 to 10 inches long; staminate catkins yellow, in rosette-like clusters, slender in anthesis and 1 to 2 inches long; ovulate catkins purplish, oblong-ovate, 6 to 8 lines long; cones reddish brown, narrowly ovate when closed, roundish ovate or oval when open, commonly 3 to 5 inches long; after opening breaking through near the base and falling, leaving the basal scales on the limb; scales with thickened or low-pyramidal apophyses, the umbo abruptly drawn down into a stout somewhat triangular point or short prickle; seeds ovatish, sometimes slightly flattened at apex, 3 to 5 lines long, the wing broadest near the middle and tapering to apex, ⅞ to 1 inch long and 4½ lines broad; cotyledons 5 to 9.

Sierra Nevada and Coast Ranges at middle altitudes, north to British Columbia, east to the Rocky Mts., south to the summit of the high mountains of Southern California and into Lower California. It is the most abundant tree in the main timber belt of the Sierra Nevada (5,000 to 7,500 feet at the south, and 3,000 to 5,500 feet at the north). In the South Coast Ranges it is comparatively scarce and its distribution more localized; it occurs in the southern Santa Lucias and north to Pico Blanco, on the Pinnacles, Santa Cruz Mts. above Laurel Station, and in the Mt. Hamilton Range in one limited locality. In the North Coast Ranges it occurs in the Napa and Mt. Hood ranges, is abundant in the inner ranges north of Clear Lake, but nowhere penetrates the Redwood Belt or reaches the neighborhood of the ocean as it does in the South Coast Ranges. It grows on rich mountain slopes, rocky cliffs, dry mesas, gravelly valley floors and is more abundant and widely distributed throughout the State than any other tree. The wood is hard, strong, but not tough, of high commercial value, commonly marketed as "white pine" but sometimes so light and fine-grained as to be graded with Sugar Pine stock and sold as such. Rougher-barked trees with inferior wood are called Bull Pine and Jack Pine by woodsmen.

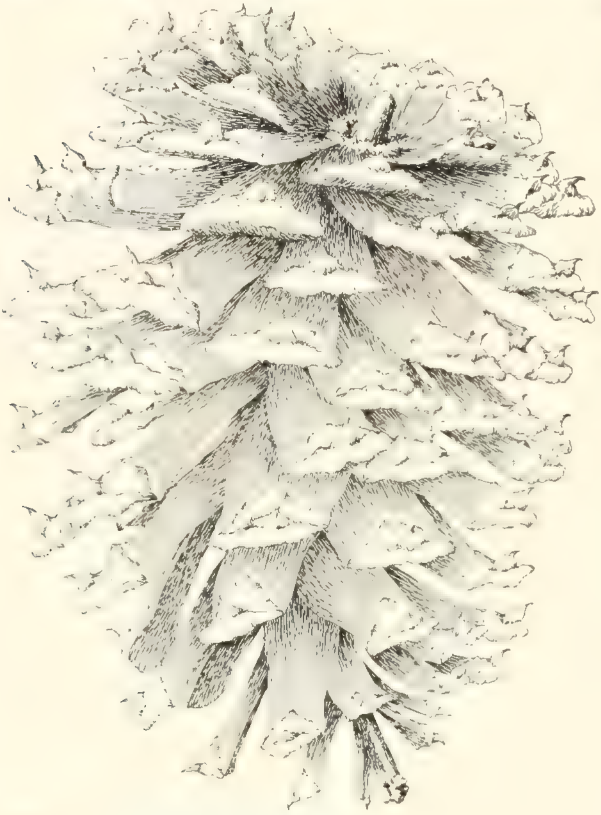
FIG. 2. PINUS PONDEROSA Dougl. Open cone, broken through near base in falling, lower scales persisting on branch. nat. size.

Var. **jeffreyi** Vasey. JEFFREY PINE. Forest tree 60 to 125 or 170 feet high with yellowish or wine-colored trunks, the bark broken into roughish plates; cones larger and denser, 5 to 10 inches long, shaped when open like an old-fashioned straw hive; prickle of the umbo often more slender; seeds often obovate, 5 to 7 lines long with a wing 12 or 13 lines long; cotyledons 7 to 13.—Sierra Nevada, the typical form in a marked belt at higher elevations (5,000 to 8,000 feet) than the species but everywhere passing over into it at lower elevations. It ranges north into southern Oregon and southward to Southern California (where it is common on the higher mountain summits) and into Lower California.

Refs.—PINUS PONDEROSA Douglas in Lawson, Man. p. 355 (1836), Comp. Bot. Mag. vol. 2, p. 111 (1836), type loc. near Spokane River, *Douglas;* Newberry, Pac. R. Rep. vol. 6, pt. 3, p. 36, pls. (1857); Jepson, Fl. W. Mid. Cal. p. 21 (1901). *P. benthamiana* Hartweg, Jour.

Hort. Soc. Lond. vol. 2, p. 189 (1847); Gordon, Jour. Hort. Soc. Lond. vol. 4, p. 212, t. (1849). Var. jeffreyi Vasey, Rep. U. S. Com. Agr. p. 179 (1875). *P. jeffreyi* Balfour, Rep. Oreg. Exped. no. 2, t. 1 (1853), type loc. Shasta Valley, *John Jeffrey.*

8. **P. murrayana** Balf. Tamrac Pine. Forest tree of symmetrical habit, commonly 50 to 80 feet, but sometimes 125 feet high, or when stunted but a few feet high; bark remarkably thin, rarely more than ¼ inch thick, light gray in color, very smooth but flaking into small thin scales; needles in 2s, 1½ to 2¾ inches long; staminate catkins 4 or 5 lines long, yellow, 15 to 60 in spike-like clusters; ovulate catkins 2 or 3 lines long, chiefly 2 in a whorl; cones chestnut brown, oblong, but more or less globose when open, 1 to 1½ inches long; scales thickened at the ends, black-banded at their tips inside, with a central umbo prolonged into a slender sub-persistent prickle; seeds 2 lines long, the wing broadly oblong, 5 or 6 lines long; cotyledons 4 or 5.

Sierra Nevada, 6,000 to 10,000 feet, southward to the San Bernardino and San Jacinto mts., north to Mt. Shasta and thence west to Marble Mt. (W.L.J. no. 2813) and the Klamath Range. Beyond our borders it ranges north to Alaska, Montana and east to Colorado. In the Sierra Nevada it forms dense forests, especially about swampy meadows, or at higher altitudes becomes a dwarfed timber-line tree. First collected by John Jeffrey, whose label on original specimen in the Herbarium of the Edinburgh Botanic Garden reads thus: "Found on the Siskiyou mountains in Lat. 43°. Elevation 7,500 feet, growing on moist deep loamy soil. Oct. 21 [1852]. This all the cones I could procure. Tree 40 feet high, of a conical form."

Refs.—Pinus murrayana Balfour, Rep. Oreg. Exped. p. 2, t. 3 (1853); Merriam, Biol. Sur. Mt. Shasta, p. 38 (1899); Jepson, Sierra Club Bull. vol. 4, p. 208, pl. 74 (1903). *P. contorta* var. *murrayana* Engelmann in Bot. Cal. vol. 2, p. 126 (1880).

9. **P. contorta** Dougl. Beach Pine. Scrub pine 2 to 35 feet high, commonly with depressed or irregular dark green crown, the trunk mostly ¼ to 1¼ feet in diameter and clothed in dark rough bark; needles in 2s, 1¼ to 2 inches long, clothing the branchlets densely; staminate catkins yellow, 20 to 65 in a spike-like cluster, conical, 3 to 4 lines long; ovulate catkins red, borne 1, 2 or 3 in a whorl, 2 lines long; cones narrowly ovate or sub-cylindric, somewhat oblique, globose when open, 1¼ to 1½ inches long, falling after 4 or 5 years or remaining on the tree many years; apophysis low pyramidal, bearing a very slender prickle which weathers away in age; seeds 1½ to 2 lines long, the wing 3 to 6 lines long; cotyledons 4 or 5.

Coast of California from the Albion River (Mendocino Co.) northward to the sand dunes of the Oregon and Washington shores and the sphagnum bogs of Alaska.

Var. **bolanderi** Vasey. Cane-like dwarfs 2 to 5 feet high with very small cones.—Mendocino "White Plains," (W.L.J. no. 2166).

Refs.—Pinus contorta Douglas in Loudon, Arb. Britt. vol. 4, p. 2292, figs. 2210, 2211 (1838), type loc. mouth of the Columbia River, *Douglas;* Lemmon, Erythea, vol. 2, p. 174 (1894). Var. bolanderi Vasey, Rep. U. S. Dept. Agr. 1875, p. 177 (1876). *P. bolanderi* Parlatore, DeCandolle, Prodr. vol. 16, pt. 2, p. 379 (1869).

10. **P. coulteri** Don. Big-cone Pine. Tree commonly 40 to 90 feet high, with conical or more often spreading crown, long lower branches, yellowish green foliage and trunks 1 to 2½ feet in diameter; trunk bark dark, roughly broken so as to form an irregular network of longitudinal fissures and sometimes loosening superficially into large thinnish scales; needles in 3s, erect, tipped with a short hard point, 5 to 10 (or 14) inches long; staminate catkins 15 to 65 in

a cluster, at length cylindric and 1 inch long; ovulate catkins in whorls of 3 to 5; cones ovate, or when open, broadly ovoid, 10 to 13 inches long and 5 to 7½ inches thick, when falling breaking through near the base; scales at tip rather abruptly passing into prominent tusk-like points or spurs which towards the base of the cone on the outer side are developed into curving talon-like appendages; seeds pinkish or yellowish, 6 to 8 lines long, the wing ¾ to 1¼ inches long; cotyledons 10 to 14.

Dry slopes and ridges: San Jacinto and San Bernardino mts. of Southern California (from 3,000 to 6,000 feet, where it attains its best development), southward into northern Lower California, northward to the Santa Lucia, San Carlos, Gabilan and Mt. Hamilton ranges. In the latter range it favors almost exclusively the eastern slope (3,000 to 4,000 feet) and grows most luxuriously on Mt. Day (W. H. Wright). The most northerly locality is Mitchell Rock, Mt. Diablo, near the village of Clayton, 800 feet altitude. The Mt. Diablo trees were described as Var. diabloensis by Lemmon (Sierra Club Bull. vol. 4, p. 130,—1902).

Refs.—PINUS COULTERI Don, Trans. Linn. Soc. vol. 17, p. 440 (1837), type loc. Santa Lucia Mts. near Twin Peaks, *Coulter;* Leiberg, 20th Rep. U. S. Geol. Sur. pt. 5 (For. Res.), pp. 422, 443 (1900). *P. sabiniana* Parry, Bot. Mex. Bound. p. 210, t. 57 (1859) not of Dougl.

11. **P. sabiniana** Dougl. DIGGER PINE. Singular pine 40 to 70 or occasionally 90 feet high, with open crown and thin gray foliage; trunk 1 to 4 feet in diameter, frequently slanting, in typical trees branching at 5 to 15 feet from the ground into a cluster of slender erect branches which form a broom-like top; needles in 3s, in drooping clusters, 7 to 13½ inches long; staminate catkins at length cylindric, 8 to 11 lines long, 8 to 21 in a spike-like cluster; ovulate catkins 6 lines long, 1, 2 or 3 in a whorl (or occasionally 2 distinct whorls on a season's shoot), borne on erect stalks 2 to 2½ inches long; one-year-old cones ovoid-globose, about 2 inches long, on recurved stalks, with the basal scales more or less free and recurved-spreading or deflexed; mature cones ovate, subglobose when open, 6 to 10 inches long, 5 to 7 inches broad, only slightly unsymmetrical, persistent on the tree 1 to 7 years, when falling breaking through near the base leaving the basal portion on the limb ("broken-cone" type); tips of the scales gradually passing into strong triangular spurs; spurs straight or curved, or even hooked, especially on lower part of cone, about 1 inch long; seeds oblong in outline, slightly flattened, slightly ridged towards the micropyle, ¾ to 1 inch long, 4 or 5 lines wide, bearing an oblique wing 3 to 5 lines long and ½ inch broad; shell hard, covered with a thin black coat which is eventually more or less deciduous; cotyledons 11 to 17.

Mountain slopes, hills and gravelly valleys: Sierra Nevada foothills, always as scattered trees or in very open stands, associated with the Blue Oak and Interior Live Oak between 500 and 1,400 feet, growing alone on the slopes or over chaparral areas between 1,400 and 3,000 feet; Coast Ranges (especially inner ranges such as Vaca, Napa, Diablo, Hamilton and San Carlos) from South Fork Salmon River (northernmost locality) and the Sacramento River Cañon south to Sierra Liebre (southernmost locality). Does not occur on the seaward North Coast Range (Redwood Belt) or only sparingly on eastern slope from Dry Creek to Cloverdale. Found on the east slope of the Santa Lucia Mts., local on west slope; also on east slope of the Santa Cruz Mts. about Saratoga. Occasionally as high as 5,000 feet (Santa Ynez Range, Kern River Valley) and as low as 175 feet (Napa Valley). Also called Gray Pine, Blue Pine and

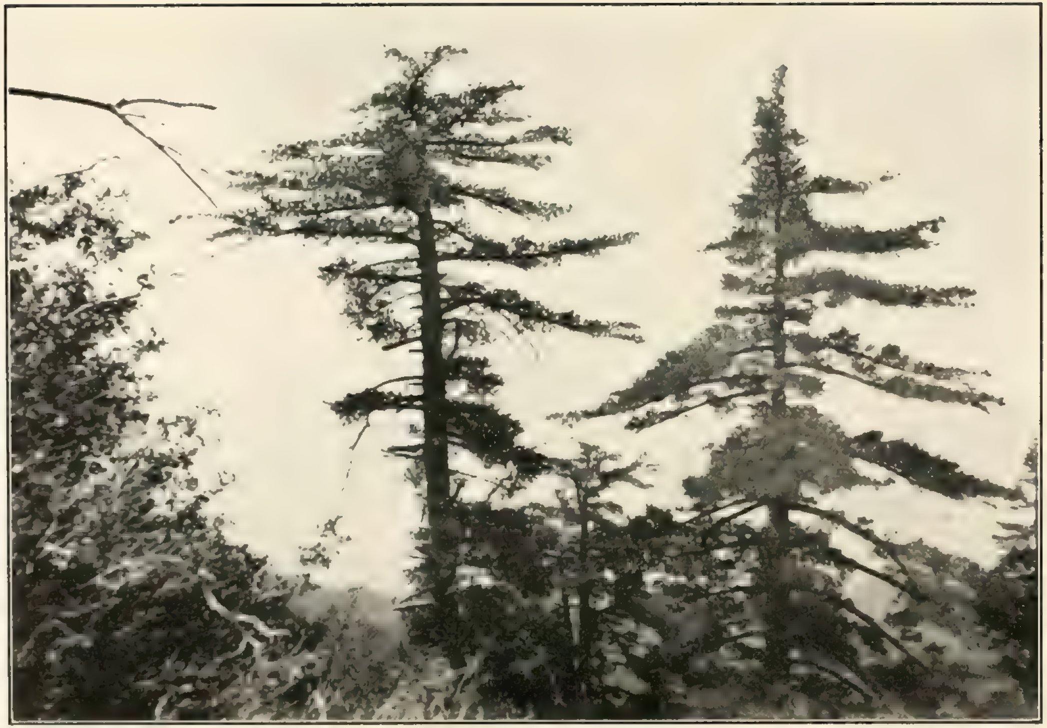

Fig. 3. Pinus lambertiana Dougl. Characteristic crowns, the branches of very unequal length. (Mt. San Jacinto.)

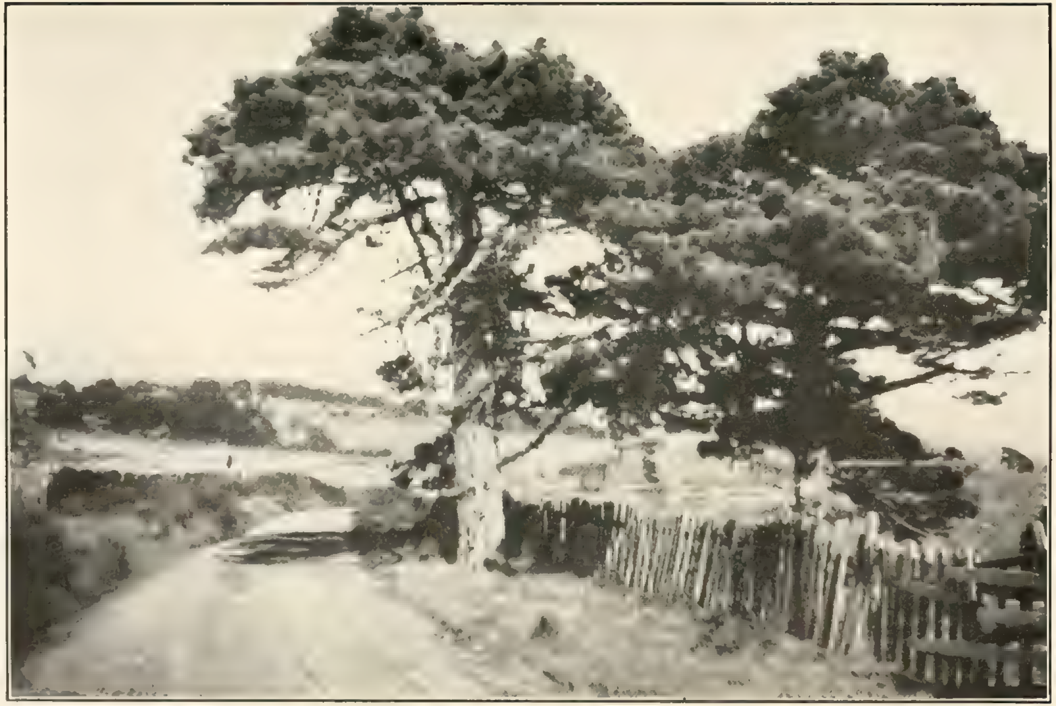

FIG. 4. PINUS MURICATA Don. Trees with flattened crowns which long ago reached normal height. The roughening of the branches is caused by the circles of cones which persist 15 to 25 years. (Road to Pt. Reyes Light in a wind-gap of the hills.)

Sabine Pine. "A well-defined species, in the happy position of having no synonyms."—Masters, 1904.

Refs.—PINUS SABINIANA Douglas, Trans. Linn. Soc. vol. 16, p. 747 (1833), type loc. probably near San Juan Bautista, *Douglas;* Davidson, Erythea, vol. 3, p. 156 (1895); Jepson, Fl. W. Mid. Cal. p. 22 (1901).

12. **P. torreyana** Parry. TORREY PINE. Low crooked or sprawling tree 15 to 35 feet high, or sometimes straight and 60 feet high; needles in 5s, 8 to 12 inches long; cones triangular ovate, 4 to $5\frac{1}{2}$ inches long, the scales at apex thickened into heavy pyramids; cotyledons 12 to 14.

Local on the San Diego coast about Del Mar (type loc.) and on Santa Rosa Island.

Refs. PINUS TORREYANA Parry, Bot. Mex. Bound. Sur. p. 210, t. 58, 59 (1859); Engelmann in Bot. Cal. vol. 2, p. 125 (1880).

13. **P. parryana** Engelm. PARRY PIÑON. Short-trunked low tree 15 to 30 feet high; needles $1\frac{1}{4}$ to $1\frac{1}{2}$ inches long, usually 4 (sometimes 2, 3 or 5) in a cluster; cones subglobose, $\frac{3}{4}$ to $1\frac{1}{2}$ inches long; seeds with rudimentary wings.

San Jacinto Range and southward into Lower California.

Refs.—PINUS PARRYANA Engelmann, Am. Jour. Sci. ser. 2, vol. 34, p. 332 (1862), in Bot. Cal. vol. 2, p. 124 (1880). *P. quadrifolia* Sudworth, U. S. Div. For. Bull. no. 14, p. 17 (1897); Sargent, Silva, vol. 11, p. 43, t. 549 (1897).

14. **P. monophylla** Torr. ONE-LEAF PIÑON. Low flat-crowned tree 8 to 25 (or 45) feet high, the trunk very short; needles 1 in a place, cylindric, curving upward and ending in an abrupt point, $1\frac{1}{2}$ to 2 inches long; staminate catkins dark red; cones subglobose, chocolate-brown or yellow, $2\frac{1}{2}$ to $3\frac{1}{2}$ inches in diameter; scales thick, raised at apex into high broad-based pyramids with slightly umbilicate or flattened summits bearing a minute deciduous prickle; seeds dark brown, oblong in outline, slightly flattened, $\frac{3}{4}$ inch long, without wings; cotyledons 7 to 10.

Desert regions of California eastward to Utah and Arizona and southward to Lower California. Scattered along eastern slope of Sierra Nevada from Sierra Co. southward; on western slope occurring in a few isolated localities on the three forks of the Kings River (5,500 to 6,500 feet) and on the walls of the Grand Cañon of the Kern (8,000 to 9,000 feet); southward to the Tehachapi Range, San Bernardino Mts. and Lower California, and westward to the San Rafael Mts. Growth always scattered. Seeds a precious article of food to the native tribes of the desert.

Refs.—PINUS MONOPHYLLA Torrey in Fremont, Rep. Second Exped. p. 319, pl. 4 (1845); Fremont, Rep. Second Exped., pp. 221, 222, 225, 226, 229 (1845), type loc. Walker River, Inyo Co., *Capt. Fremont;* Masters, Ann. Bot. vol. 2, p. 124 (1888); Leiberg, 20th Rep. U. S. Geol. Sur. pt. 5 (For. Res.), pp. 423, 444 (1900).

15. **P. muricata** Don. BISHOP PINE. (Figs. 4 and 5.) Littoral tree 40 to 80 feet high with trunk 1 to 3 feet in diameter, the axis and branches with persistent circles of cones from near the base to the summit; bark 1 to $1\frac{1}{2}$ inches thick, dark red, brown on the surface, soft and brittle, broken by fissures into rough ridges; needles in 2s, 4 to 6 inches long; staminate catkins ovate, 3 or 4 lines long, 12 to 60 in a cluster, their peduncles exserted from the winter bud; ovulate catkins 2 to 5 in a whorl, 1 to 5 whorls on a season's shoot; cones broadly ovate, acute, 2 to 3 inches long, almost as broad, or when open more or less globose, borne 3, 4 or 5 in a circle, gradually turned downward, developed more strongly on the outside towards the base and in consequence always one-sided;

scale-tips rhomboidal, bearing a central prickle with a broad base, or developed into stout straightish or upwardly curving spurs; seeds black, sometimes mottled, the thin shell minutely roughened on the surface, 2½ to 3 lines long, wings narrow, 5 to 8 lines long, 2½ to 3½ lines broad; cotyledons 4 to 7.

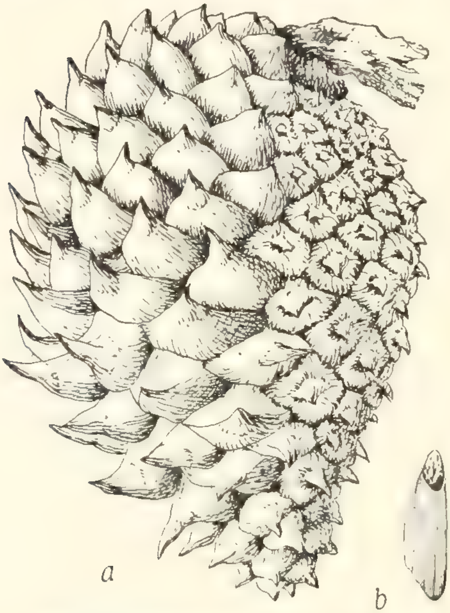

Fig. 5. Pinus muricata Don. *a*, Closed cone; *b*, seed. nat. size.

Low swampy lands or clay hills bordering the sea: North Coast Ranges from Inglenook, Mendocino Co. (W.L.J. no. 2161) southward nearly to Bolinas, attaining its best development on the Sonoma coast; South Coast Ranges at Monterey (Dr. Abbott; W.L.J. no. 2986) and San Luis Obispo Co.; Lower California between Ensenada and San Quentin and on Cedros Island. Fire type of pine, its cones remaining closed 10 to 20 years, or opening after a forest fire and reseeding the area. Stands dense but of very limited extent. First discovered by Dr. Thos. Coulter in the Santa Lucia Mts. near San Luis Obispo, 3,000 feet altitude and 10 miles from the sea.

Refs.—Pinus muricata Don, Trans. Linn. Soc. vol. 17, p. 441 (1837); Torrey, Bot. Mex. Bound. p. 209, pl. 54 (1859); Purdy, Gard. & For. vol. 9, p. 242 (1896); Jepson, Fl. W. Mid. Cal. p. 23 (1901).

16. **P. radiata** Don. Monterey Pine. (Fig. 6.) Beautiful, symmetrical tree or in age with flattened or broken top, 30 to 70 or 115 feet high; foliage rich dark green; trunk 1 to 4 feet in diameter; bark hard and more nearly black than that of any other Californian pine; needles in 3s, or a few in 2s, 3 to 6 inches long; staminate catkins yellow, 20 to 40 in a cluster, conic-cylindric, 6 or 7 lines long, the peduncles not exserted from the winter bud; ovulate catkins peduncled, borne 2 to 5 in a whorl, 1 to 3 whorls formed on a shoot in a season; cones tan-color or cinnamon, deflexed, sessile and unequally developed, broadly ovoid and bluntly pointed, globose when open, 2½ to 4½ inches long; scales on the outer side toward the base conspicuously swollen at tip into a hemispherical tubercle or boss and armed with a prickle which usually weathers off; seeds black, minutely roughened on the surface, 3 lines long, bearing a broadly oblong brown wing 2½ to 3 times as long; cotyledons 5 to 8.

Near sea on south coast: about Pescadero, San Mateo Co.; Monterey (type loc., Thos. Coulter); San Simeon Bay; Santa Rosa, Santa Cruz and Guadalupe islands. Although naturally confined to a few localities of limited area, it takes kindly to cultivation in all temperate regions of the earth and has a wider horticultural distribution than any other Californian tree. It is commonly planted along the Pacific Coast for ornament and as a shelter tree but is short-lived in the dry interior valleys.

Refs.—Pinus radiata Don, Trans. Linn. Soc. vol. 17, p. 442 (1837); Lemmon, Erythea, vol. 1, p. 224 (1893); Jepson, Fl. W. Mid. Cal. p. 22 (1901). *P. insignis* Douglas in Loudon, Arb. Britt. vol. 4, p. 2265, figs. (1838); Engelmann in Bot. Cal. vol. 2, p. 127. *P. tuberculata* Don, Trans. Linn. Soc. vol. 17, p. 442 (1837).

17. **P. tuberculata** Gord. KNOB-CONE PINE. Tree 5 to 30 or sometimes 85 feet high, with slender trunks $^1/_3$ to 1 foot in diameter and rather thin pale yellow-green foliage; needles in 3s, 3 to 5 inches long; staminate catkins brownish purple, narrowly conic, 5 to 7 lines long, 50 to 60 in spike-like clusters; ovulate catkins dark-red or straw-brown, on peduncles $^3/_4$ to 1 inch long, 3 to 5 (or 7) in a whorl, 1 to 3 whorls formed on a season's shoot; cones strongly deflexed, buff in color, narrowly ovate, oblique, acutely or bluntly pointed and somewhat curved, especially at tip, 3 to 6 inches long; scales moderately thickened at tip, except on the outside towards the base where they are raised into conspicuous rounded or pointed knobs; umbos small and contracted into slender prickles which, on old cones, weather away or persist towards the apex; seeds brownish black, 3 to 4 lines long, the surface minutely roughened, the wing 9 to 12 lines long and 3 to 4 lines broad; cotyledons 5 to 8.

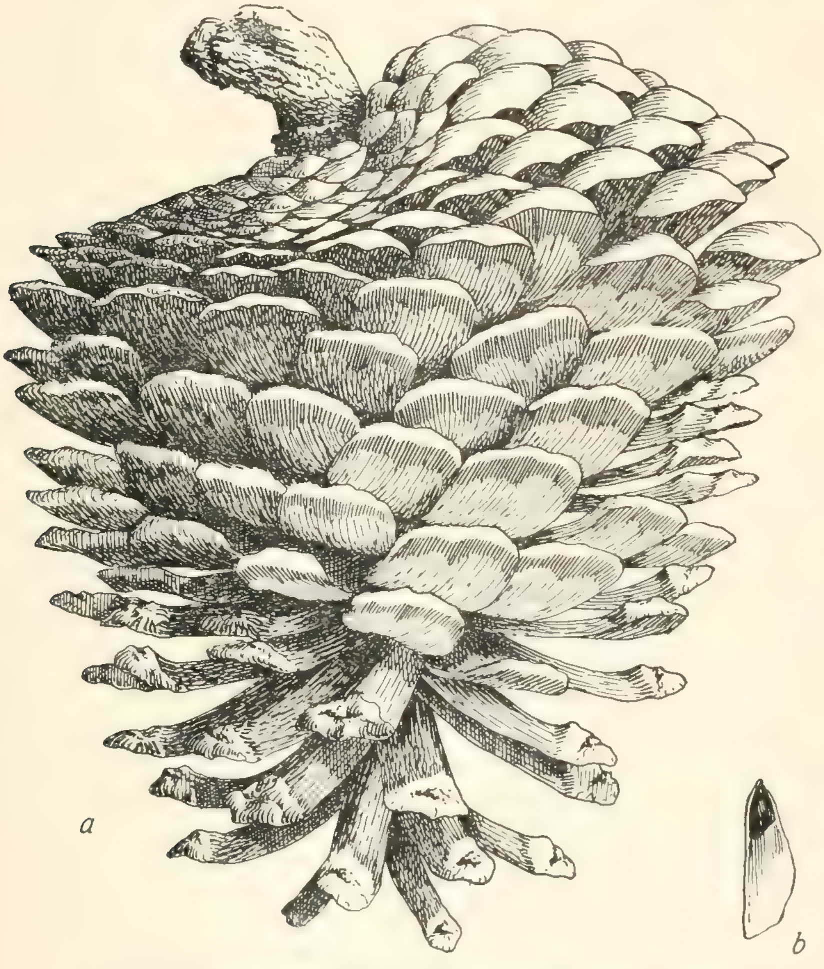

FIG. 6. PINUS RADIATA Don. *a*, Open cone; *b*, seed. nat. size.

Sierra Nevada and Coast Ranges, arid situations with barren or rocky soil, chiefly between 1,500 and 3,000 feet, widely distributed but the localities comparatively few and rarely abundant in a locality except in Siskiyou and Del Norte cos. and southwestern Oregon. Ranges southward to San Bernardino and San Jacinto mts. Fire type of pine, the cones remaining closed 15 to 30 years, or until opened by a forest fire when the species reproduces itself abundantly on the burned area. The following stations may be noted: Devils Backbone, near Trinity Summit; Bartlett Mt.; near Mt. Konokti; Mt. St. Helena; Moraga Ridge; near Post Summit, Santa Lucia Mts.; Kinsley, Mariposa Co.; Forest Hill; Fall River; Mt. Shasta. (Type loc. Santa Cruz Mts., Theo. Hartweg.)

Refs.—PINUS TUBERCULATA Gordon, Jour. Hort. Soc. Lond. vol. 4, p. 218, t. (1849), not Don. *P. attenuata* Lemmon, Min. Sci. Press, vol. 64, p. 45 (1892), Erythea, vol. 1, p. 231 (1893); Jepson, Fl. W. Mid. Cal. p. 22 (1901); Merriam, Biol. Sur. Mt. Shasta, p. 33 (1899).

2. **TSUGA** Carr. HEMLOCK.

Slender trees with nodding leading shoots. Leaves linear; resin canal 1; petioles jointed on a woody base which persists after leaf-fall as a decurrent projection roughening the branchlet. Staminate catkins pendulous, consisting of a subglobose cluster of stamens on a long peduncle arising from an axillary winter bud. Anthers subglobose, tipped with a short spur or knob, their cells opening transversely. Ovulate catkins erect, from terminal winter buds. Cones maturing in the first autumn, solitary on ends of branchlets, pendent; scales thin, longer than the bracts. Seeds with resin vesicles on the surface; cotyledons 3 to 6.—Seven species, 2 in eastern North America, 2 in western North America, 2 in Japan and 1 in the Himalayas. (Tsuga, its Japanese name.)

Leaves in flat sprays; cones $\frac{1}{2}$ to 1 inch long.......... ....1. *T. heterophylla.*
Leaves spreading around stem; cones $1\frac{1}{2}$ to 3 inches long................2. *T. mertensiana.*

1. **T. heterophylla** Sarg. COAST HEMLOCK. Graceful conifer, 100 to 180 feet high, with trunk 1 to 4 feet in diameter, the branches and branchlets slender, forming sprays which droop cascade-wise but not pendulous; trunk bark brown on the surface, dark red inside, shallowly fissured longitudinally or nearly smooth, $\frac{1}{2}$ to $\frac{3}{4}$ inch thick, or sometimes twice as thick and deeply broken into small oblong plates an inch high, producing an irregularly warty appearance; branchlets finely hairy with the leaves mostly spreading in 2 ranks; leaves linear, flat, 3 to 8 lines long, $\frac{1}{2}$ to 1 line wide, blunt at apex, upper side green and with a median furrow, lower side white and with a median ridge, contracted at base into a short but distinct petiole; staminate catkins subglobose, about 2 lines long, borne on thread-like peduncles 2 or 3 lines long, occurring at the ends of branchlets; cones oblong or conical when closed, roundish when open, $\frac{1}{2}$ to $\frac{3}{4}$ or 1 inch long, pendulous and solitary on the tips of the branchlets; scales longer than broad, roundish at apex, with entire edge; bracts about one-sixth the length of the scales, broadly triangular with truncate or obtuse summits; seeds light-brown, $1\frac{1}{4}$ line long, the wing 3 or 4 lines long and twice the breadth of the seed.

West slope of the outer Coast Range from Elk Creek, Mendocino Co., north to Oregon and Alaska, and eastward to western Montana. Scattered singly through the Redwood forest, abundant beyond our borders. Long attributed to Marin Co. but no definite station ever given and believed not to exist in that county. Also called "Western Hemlock."

Refs.—TSUGA HETEROPHYLLA Sargent, Silva N. Am. vol. 12, p. 73, t. 605 (1898); Jepson, Fl. W. Mid. Cal. p. 19 (1901). *Abies heterophylla* Rafinesque, Atlant. Jour. vol. 1, p. 119 (1832). *T. mertensiana* Carriere, Traite Conif. ed. 2, p. 250 (1867); Engelmann in Bot. Cal. vol. 2, p. 120 (1880). Western Hemlock, Allen, U. S. Bur. For. Bull. no. 33 (1902).

2. **T. mertensiana** Sarg. ALPINE HEMLOCK. Alpine tree 25 to 90 (rarely 115) feet high, with conical trunk ½ to 2½ feet in diameter, bearing branches quite to the ground and forming pyramidal bases which are soon narrowed to slender tops; branches slender, horizontal or mostly drooping, the branchlets slender, pubescent and drooping; leaves standing out all around the branchlet, flattish above, strongly ridged below, bearing stomata on both surfaces, bluntish at apex, ¼ to 1 inch long, less than 1 line wide, shortly petioled; staminate catkins mostly violet-purple, 2 lines long, on peduncles 2 to 3 lines long; cones cylindric and tapering to base and apex, 1½ to 3 inches long, ½ to ¾ inch in diameter; opened cones oblong in outline or tapering from base to apex, 1 to 1¼ inches in diameter; scales thin, rounded at apex, in the open cone spreading at right angles to the axis or even recurving, their bracts ⅓ to ⅖ as long, rounded above and tipped with a short point; seeds 2½ lines long, the wing 4 or 5 lines long.

Timberline tree in the Sierra Nevada, 6,000 to 11,000 feet, in frequent patches of limited extent, from Bubb's Creek northward to Mt. Shasta, westward to the Trinity Mts., Marble Mt. (W.L.J. no. 2820), Klamath Range and Siskiyous, far north to Alaska and northern Montana. Fruit-bearing branchlets often forming dense drooping clusters of cones in top of tree. Trunks on sharp slopes kneed or curved at base from the weight of snow on the stems when young. Also called Black Hemlock and, in former times, "Williamson Spruce."

Refs.—TSUGA MERTENSIANA Sargent, Silva N. Am. vol. 12, p. 77, t. 606 (1898). *Pinus mertensiana* Bongard, Veg. Sitcha, p. 163 (1833), type loc. Sitka, *Dr. R. H. Mertens*. *Abies williamsonii* Newberry, Pac. R. Rep. vol. 6, pt. 3, p. 53, t. 7, f. 19 (1857). *Tsuga pattoniana* Seneclauze, Conif. p. 21 (1867); Engelmann in Bot. Cal. vol. 2, p. 121 (1880); Sargent, Gard. & For. vol. 10, p. 1, figs. 1, 2 (1897).

3. PICEA Link. SPRUCE.

Trees with tall tapering trunks and thin scaly bark. Leaves narrowly linear, spreading on all sides, jointed near the stem on a woody base which persists after leaf-fall as a prominent spreading "peg;" resin canals in ours 2. Staminate catkins from terminal or axillary winter buds, erect or nodding; anthers with nearly circular toothed crests, opening longitudinally. Ovule-bearing catkins erect. Cones maturing in the first autumn, pendent, usually scattered over the upper half of the tree; scales very thin, the bracts shorter than the scales. Seeds without resin vesicles; cotyledons 4 to 15.—About 12 species, 7 in North America, the remainder in Europe and Asia. (Picea, ancient Latin name, from pix, pitch.)

Leaves prickly pointed; cone-scales serrulate; coastal........................1. *P. sitchensis.*
Leaves merely acute; cone-scales entire; subalpine........................2. *P. breweriana.*

1. **P. sitchensis** Carr. TIDELAND SPRUCE. Forest tree 80 to 190 feet high, with trunk 3 to 20 feet in diameter, wide spreading rigid branches, and drooping branchlets; trunk bark reddish brown, developing roughish deciduous scales, but these not so sharply defined as in spruces generally; branchlets with the leaves spreading equally in every direction but not straight down on the under side of horizontal ones; leaves linear, ½ to 1 inch long, ⅔ to 1 line

wide, whitened and flat above but with a median ridge, convex or strongly ridged below, very stiff and usually tapering to a prickly point or the upper leaves less sharp or bluntly pointed; staminate catkins purple, 1 to 2½ inches long and 3 to 6 lines in diameter, borne on a peduncle 2 or 3 lines long, appearing from large conspicuously scaly winter buds which are either terminal or lateral on the branches; ovulate catkins erect or curving upwards, 1¼ to 1¾ inches long, yellowish green, the bracts longer than the scale; cones dull brown, long oblong, 2 to 4 inches long and when open 1¼ to 1½ inches in diameter; scales narrow, finely and irregularly toothed, with ovate-lanceolate bracts ½ to ⅔ as long; seeds 1⅓ lines long, the wing 3 to 4 lines long and 1½ to 2 lines broad.

Lowlands facing the ocean from Caspar, Mendocino Co., northward to Alaska. Forms pure forests on low moist flats as at Crescent City, or about the mouth of the Eel River where the tall wind-beaten trees are a striking feature of the scenery. The tallest trees of this species in California occur in the western margin of the Redwood Belt in Del Norte Co. (W.L.J. no. 2905), where the trunks, as also northward, are enormously buttressed at base; trunks 2 to 6 feet in diameter at 6 feet above the ground are nearly twice that diameter at the ground. Extensively lumbered. In cultivation called Sitka Spruce and, formerly, Menzies Spruce.

Refs.—PICEA SITCHENSIS Carriere, Traite Conif. p. 260 (1855). *Pinus sitchensis* Bongard, Veg. Sitcha, p. 164 (1833), type loc. Sitka, *Dr. Mertens. Abies menziesii* Lindley, Penny Cycl. vol. 1, p. 32 (1833); Newberry, Pac. R. Rep. vol. 6, pt. 3, pp. 56, 90, f. 21, pl. 9 (1857).

P. ENGELMANNI Engelm. Engelmann Spruce. Branchlets pubescent; cones 2½ to 3 inches long, 1½ inches in diameter when open, scales broad.—Rocky Mts. to Arizona and Washington; also near California boundary on Ashland Butte, Oregon, W.L.J. no. 2573.

2. **P. breweriana** Wats. WEEPING SPRUCE. Singular subalpine tree 20 to 95 feet high; branches clothing the trunk to the ground, few and mainly horizontal, especially in the top, ornamented with cord-like branchlets hanging straight down and thus giving a formal effect to the stiffish and very thin crown; trunk ½ to 3½ feet in diameter, its bark thin (½ inch thick), whitish and smoothish on the surface but presenting shallowly concave scars from which have fallen thick scales of irregular shape, mostly 1 to 4 inches long and half as wide; inner bark white, outer bark red-brown; leaves borne all round the stem, ½ to 1 inch long, roundish and green below, whitish above on either side the conspicuous median ridge, obtuse at apex; staminate catkins yellow-brown, 1 inch long; ovulate catkins dark purple, 1¼ inches long, with the sides of the scales towards the apex turned up in such a way that the surface of the catkin presents rhomboidal areas; bracts appressed, with finely toothed edges; cones narrowly cylindrical, 3½ to 4¼ inches long, 1¼ to 1½ inches in diameter; scales rounded at apex, very thick for a spruce and with smooth entire edges; bracts oblong, acute, ⅕ to ¼ as long as the scales; seeds 1½ lines long, the wing 4 lines long.

Local subalpine species, favoring cup-like hollows at head of north cañons where the snow-drifts persist until July or later. It ranges from northern Trinity to the western side of Marble Mt. (W.L.J. no. 2847), eastern slope of the Klamath Range (W.L.J. no. 2890), through the Siskiyous, northward to the high mountains south of Rogue River and westward to the Oregon

Coast Range. Singular tree, remarkable for its long slender cord-like branchlets perfectly pendulous from the usually horizontal limbs.

Refs.—PICEA BREWERIANA Watson, Proc. Am. Acad. vol. 20, p. 378 (1885), type loc. summit of the Siskiyous on Happy Camp Trail, *Thos. Howell* (1884).

4. **PSEUDOTSUGA** Carr. FALSE SPRUCE.

Large trees with flat, short-petioled leaves, spreading around the stem or on horizontal branches often somewhat 2-ranked. Staminate catkins axillary, the anthers tipped with a spur and opening obliquely. Ovulate catkins erect, terminal or axillary. Cones pendent, maturing in the first autumn; scales thin, rounded, shorter than the slender acutely 2-lobed bracts which bear a spear-like point in the notch. Seeds without resin vesicles; cotyledons 5 to 12.—Three species, 2 in America and 1 in Japan. In botanical relationship it stands in an intermediate position among Picea, Tsuga, and Abies. The general habit and branching, the leaves spreading all around the stem, the medium-sized pendent cones borne all over the tree, the persistent cone-scales, the seed without resin vesicles—in all these features it resembles Picea, differing from it most markedly in its bark, which is not thin and scaly, and in its exserted bracts. In its petioled blunt leaves, often pendent leader of very young trees, and persistent cone-scales it is like Tsuga. In its roughly fissured thick bark and exserted bracts it resembles Abies. Its peculiar cone bracts, signally different from those of any other conifer, and the obliquely dehiscing anthers are the chief marks of the distinctive genus Pseudotsuga. (Name from Greek, pseudo, false, and Japanese, tsuga, hemlock.)

Cones 1¾ to 3½ inches long; bracts conspicuously exserted; Sierra Nevada and Coast Ranges ....1. *P. taxifolia*
Cones 4 to 7½ inches long; bracts protruding little; S. California only......2. *P. macrocarpa*

1. **P. taxifolia Britt.** DOUGLAS FIR. DOUGLAS SPRUCE. (Figs. 7 and 8.) Forest tree 70 to 200 feet in height, in dense stands often exhibiting clear trunks 100 to 150 feet high and 4 to 8 feet in diameter; bark on young trees thin, smooth, gray or mottled, sometimes alder-like, on old trunks 1 to 6½ inches thick, soft or putty-like, dark brown, fissured into broad heavy furrows, in cross section showing alternate layers of red and white; branchlets usually drooping, the leaves spreading all around the stem or on horizontal branchlets spreading more or less to right and left but not truly 2-ranked; leaves ½ to 1½ inches long, ½ to 1 line wide, linear, blunt at apex, flat with a median groove above and green, below with 2 pale longitudinal bands and a median ridge, very short-petioled; staminate catkins conic-cylindric, 4 or 5 lines long, exserted from winter buds on a peduncle 2 or 3 lines long and scattered along the under side of the branchlets; pistillate catkins erect, terminal or lateral, 1 inch long, the bracts very conspicuous on account of the small size of the scales at this stage; cones pendulous, long oval and more or less pointed, 1¾ to 2½ or 3½ inches long, 1¼ to 1¾ inches in diameter when open; scales broad and rounded at apex; bracts conspicuously exserted, broadly linear and bearing in the deep notch at apex a spear-like point; seeds 3 lines long, almost as long as the wings; cotyledons 5 to 8.

Sierra Nevada from Mt. Shasta and Lassen Peak southward to Fresno Co. (Stevenson Creek, 3,000 to 5,500 feet). Coast Ranges, from Santa Lucia Mts. (southern limit in California), Santa Cruz Mts., Bolinas Ridge, Inverness Ridge, outer North Coast Range, Mt. Hood and Napa ranges, Upper Cache

Creek, and northward to the Siskiyous; associated with the Redwood in the outer range and with Tan Oak, Madroña, Black Oak and Yellow Pine in the inner ranges. The characteristic "Bald Hills" of Mendocino and Humboldt (inner ranges) with their "opens" and mixed woods of Douglas Fir and the species just mentioned are well shown in Fig. 8. Not in Vaca Mts., Mt. Diablo and Mt. Hamilton ranges nor Oakland Hills (Cf. Jepson, Fl. W. Mid. Cal. 19,—1901). Widely distributed beyond our borders, reaching British Columbia (type loc. Nootka, Archibald Menzies), South Dakota, northern Texas and Mexico. Largest tree of the Pacific Coast next to the Sequoias. Variable in habit of branchlets and hue of foliage. Growth rapid and reproduction strong. Timber unequalled for its strength and lightness and the size of the sticks; well-known in the lumber trade as "Oregon Pine."

Refs.—PSEUDOTSUGA TAXIFOLIA Britton, Trans. N. Y. Acad. Sci. vol. 8, p. 74 (1889). *Pinus taxifolia* Lambert, Pinus, vol. 1, p. 51, t. 33 (1803). *Abies douglasii* Lindley, Penny Cycl. vol. 1, p. 32 (1833); Newberry, Pac. R. Rep., vol. 6, pt. 3, pp. 54, 90, pl. 8, fig. 20 (1857). *Pseudotsuga douglasii* Carriere, Traite Conif. ed. 2, p. 256 (1867); Engelmann in Bot. Cal. vol. 2, p. 120 (1880).

2. **P. macrocarpa** Mayr. BIG-CONE SPRUCE. Tree 30 to 60 or occasionally 80 feet tall, with very long lower branches; bark, foliage, catkins, and cones very similar to those of the preceding; bark dark or black; leaves slightly curved; cones 4 to 7½ inches long, 2 to 3 inches in diameter when open; bracts protruding little or not at all beyond the scales, except the lowest, the tails of which are often as much as ¾ inch long; cotyledons 6 or 7.

Cañons and north slopes: Tejon Cañon and San Emigdio Mts. westward to the San Rafael and Santa Inez ranges, southward to the Sierra Madre, San Bernardino Mts. (where it reaches its greatest development), Palomar, and Cuyamaca Mts. Recurs on San Pedro Martir in Lower California. Altitudinally it may be considered as a transition species from the upper part of the chaparral to the lower part of the Yellow Pine belt. Adapted to drier conditions than its congener, the Douglas Fir.

Refs.—PSEUDOTSUGA MACROCARPA Mayr, Wald. Nordam, p. 278 (1890). *Abies douglasii* var. *macrocarpa* Torrey in Ives, Rep. Colo. River, pt. 4, p. 28 (1860). *Pseudotsuga douglasii* var. *macrocarpa* Engelmann in Bot. Cal. vol. 2, p. 120 (1880).

5. **ABIES** Link. FIR.

Highly symmetrical trees of lofty stature, the branches in regular whorls and ramifying laterally, forming flat sprays. Leaves linear, about a line wide, flat or 4-angled, whitened beneath, spreading in two opposite directions or even 2-ranked, or more often curving upwards, leaving a smooth circular scar when they fall; resin canals in ours 2. Catkins from axillary winter buds. Staminate catkins borne on the under side of the branches, mostly in the upper half of the tree; anthers tipped with a knob, their cells opening transversely. Ovulate catkins erect, on the upper side of the topmost spreading branches. Cones erect, maturing in the first autumn, falling to pieces on the tree; scales thin, incurved at the broadened apex; bracts often exserted. Seeds with resin vescicles; cotyledons 4 to 10.—Northern hemisphere, especially in the high mountains or far north, some 23 species; 7 species on the Pacific Coast, 2 of them beyond our borders. (Abies, the ancient Latin name.)

Leaves of lower and uppermost branches slightly different.
  Cones 2 to 5½ inches long; bracts not exserted.
    Leaves glaucous or dull green, flat or on cone-bearing branches keeled above, acute or rarely notched at apex, spreading in two ranks or curving upwards, with a

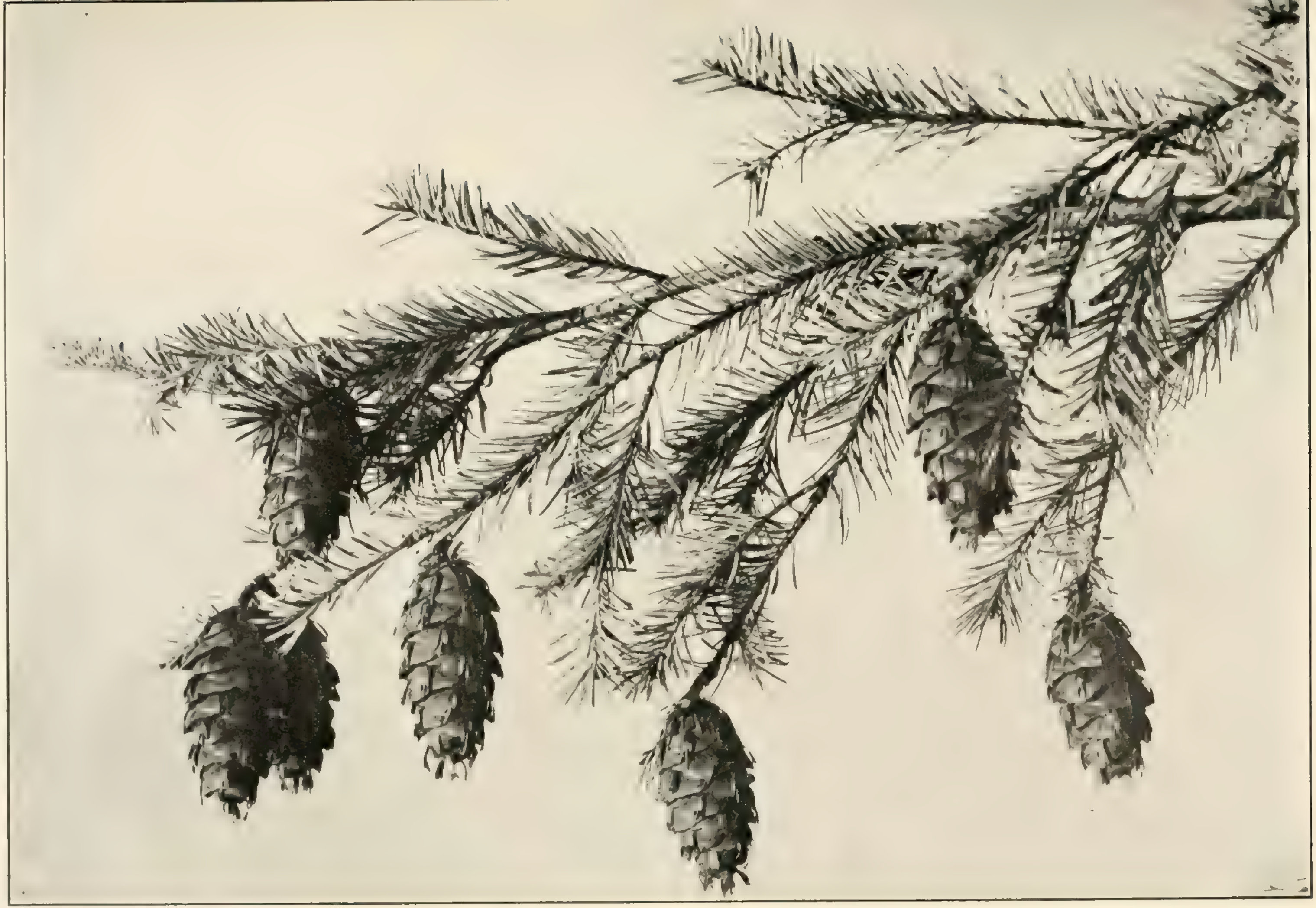

Fig. 7. Pseudotsuga taxifolia Britt., fruiting branch.

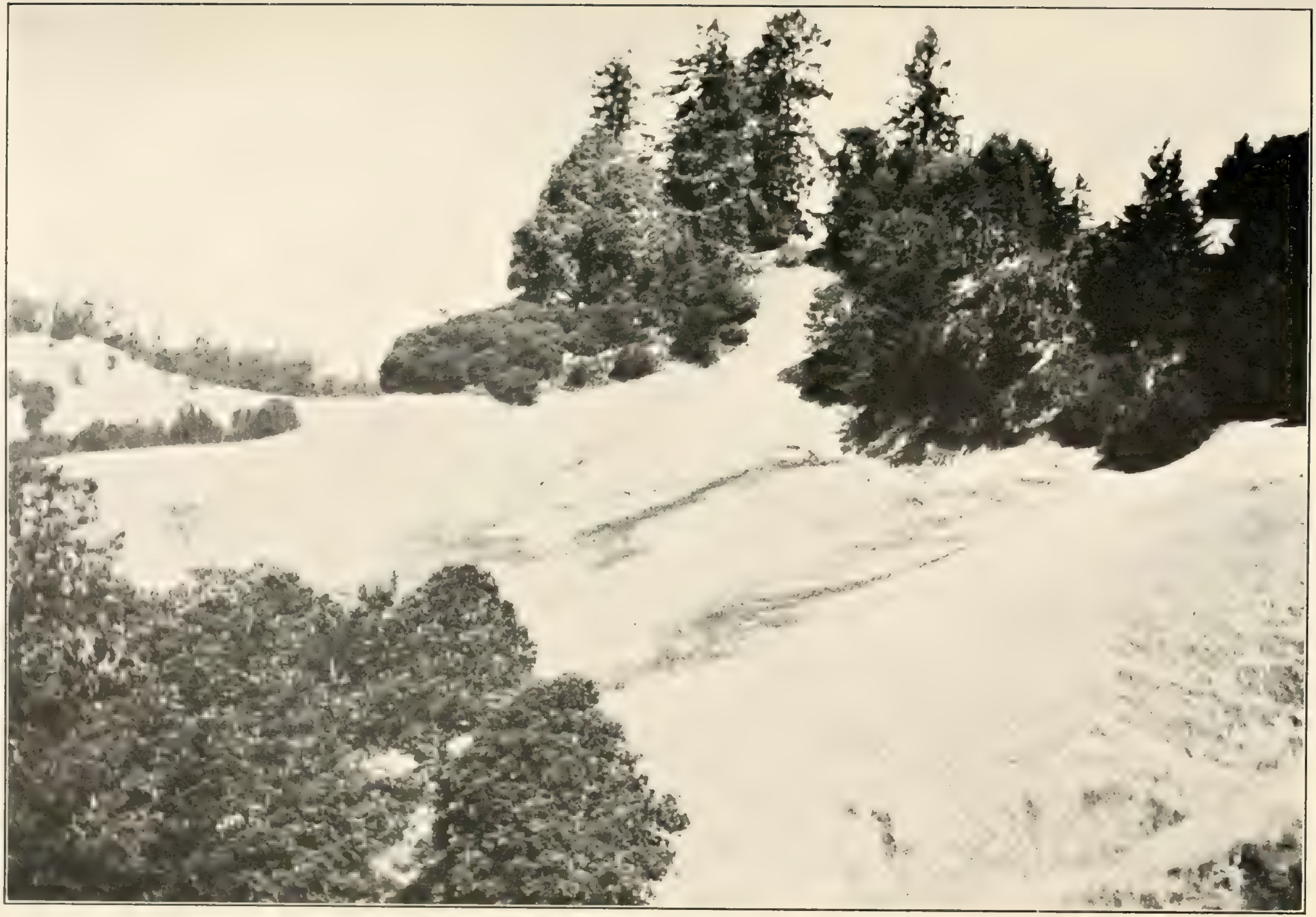

FIG. 8. "BALD HILLS" of Mendocino and Humboldt counties. Clusters of PSEUDOTSUGA TAXIFOLIA Britt. and PASANIA DENSIFLORA Oerst.; QUERCUS GARRYANA Dougl., at lower left hand corner; UMBELLULARIA CALIFORNICA Nutt., clump half concealed in head of cañon at left. Characteristic "opens" and wet swales between the groves, the high grass whitened by the midsummer heat.

twist in the short petiole; old bark roughly and deeply furrowed, drab or grayish; high Sierra and Coast mts. . . . . 1. *A. concolor.*

Leaves dark lustrous green, white beneath, notched at apex, usually spreading in two ranks, on cone-bearing branches often blunt, curving upwards; bark white, smooth or fissured into low flat ridges; north coast only. . . . . 2. *A. grandis.*

Cones 4 to 8 inches long, the bracts concealed or exserted; leaves ridged above and below so as to be 4-sided, somewhat compressed, thicker on the uppermost branches, curving upwards but not twisted, sessile; old bark deeply divided into roughly broken ridges, reddish brown; high Sierra and Coast mts. . . . . 3. *A. magnifica.*

Cones 4 to 5 inches long, the exserted bracts reflexed, usually concealing the scales; leaves of lower branches flattened, distinctly grooved above; Trinity Summit to Washington. . . . . 4. *A. nobilis.*

Leaves alike all over tree; cones with conspicuous bracts, the exserted portion long and bristle-like; bark light brown, smoothish; Santa Lucia Mts. only. . . . . 5. *A. venusta.*

1. **A. concolor** Lindl. & Gord. WHITE FIR. (Fig. 9.) Forest tree 60 to 150 or 200 feet high, with a narrow crown composed of flat sprays and a trunk naked for $\frac{1}{3}$ to $\frac{1}{2}$ its height and 1 to 6 feet in diameter; bark smooth, silvery or whitish in young trees, becoming thick and heavily fissured into rounded ridges on old trunks and gray or drab-brown in color, in section showing dull brown areas separated by a coarse light-colored mesh; leaves $\frac{1}{2}$ to $2\frac{1}{2}$ (commonly 1 to $1\frac{1}{2}$) inches long, flat, often with a median channel on upper side, or on the uppermost branches keeled, a prominent midrib

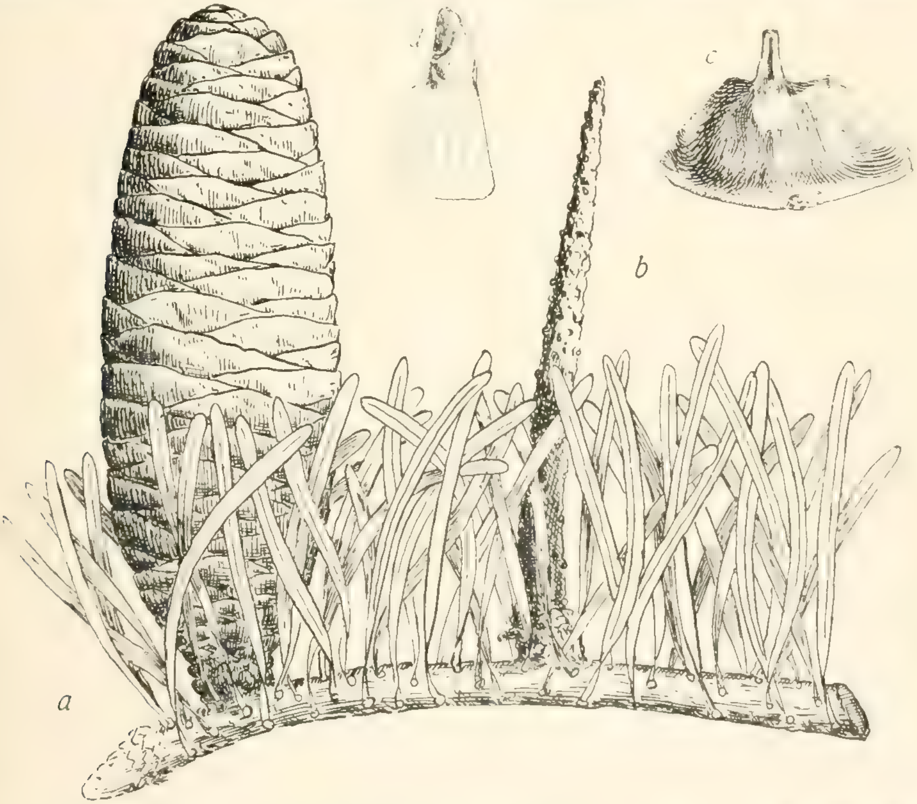

FIG. 9. ABIES CONCOLOR Lindl. & Gord., fruiting branch. *a*, Cone; *b*, axis from which scales have fallen; *c*, scale and bract; *d*, seed. nat. size.

beneath with a broad depressed stomatal band on either side, contracted at base into a very short petiole, acutish, obtuse or slightly notched at summit, spreading in two ranks or more or less erect by a twist in the very short petiole; staminate catkins cylindric, straw-yellow or red, ½ inch long or less; cones brown, oblong, rounded at summit and base, 2 to 5½ inches long, 1 to 1¾ inches in diameter; scales broad and rounded; bracts about ½ as long as the scales, roundish and finely toothed, often with a notch at top and usually terminating in a short slender point; seeds 5 lines long, the wing 6 or 7 lines long, truncate at the end, 5 or 6 lines wide, widening towards the apex.

Mountain slopes: Sierra Nevada and Coast Ranges, north to southern Oregon, east to Colorado and New Mexico, south into Lower California. One of the four most abundant forest trees in the main timber belt of the Sierra Nevada, chiefly between 3,500 and 7,500 feet in the north and 5,000 and 8,300 feet in the south. High North Coast Ranges from the Siskiyous and Marble Mt. (where it is abundant) south along the Yollo Bolly range to Snow Mt., thence a gap of 360 miles to Mt. Pinos and the San Rafael Mts. in South Coast Ranges. Abundant on the summits of the mountains of Southern California (5,000 to 11,500 feet). Makes second grade saw-timber, useful for fruit boxes and ordinary construction. Also, but wrongly, called Silver Fir.

Refs.—ABIES CONCOLOR Lindl. & Gord., Jour. Hort. Soc. Lond. vol. 5, p. 210 (1850), the type from near Santa Fe, New Mexico, *Aug. Fendler*. *A. lowiana* Murray, Proc. R. Hort. Soc. vol. 3, p. 317, figs. (1863).

A. LASIOCARPA Nuttall. Alpine Fir. Related to preceding; cones 2½ to 4 inches long, the rounded or emarginate bracts with long slender but not exserted tips.—Rocky and Cascade mountains to Alaska.

A. AMABILIS Forbes. Amabilis Fir. Cones 3½ to 6 inches long, the slender-tipped bracts ½ as long as scales.—Cascade Mts.

2. **A. grandis** Lindl. LOWLAND FIR. Forest tree 40 to 160 or rarely 275 feet high with horizontal branches, the trunk 1 to 3 feet in diameter and vested in a white or light brown bark which is very smooth or shallowly broken into low flat ridges; in section the inner bark light brown, the outer bark dark red with a mesh of purple lines running through it; horizontal branches with the leaves spreading by a twist at base in two ranks and so making a flat spray, or in any event tending to right and left, those originating on top of the stem having the peculiarity of being much shorter than those coming from the sides; leaves flat, 1 to 2 inches long, notched at apex, the upper side dark lustrous green and with a median channel, the lower side with two white bands separated by a ridge; staminate catkins straw-color, cylindric, 5 or 6 lines long, borne on a peduncle 3 or 4 lines long, the crest of the anthers mostly 2-toothed; ovulate catkins borne in upper half of the tree; cones long-oblong in outline, 2½ to 4 inches long, 1½ to 1¾ inches in diameter; scales with a broad rounded summit, and narrow stalk-like base, broader than long; bracts very small, with a short awl-like point set on the roundish apex, half as long as the scales; seeds drab-color, 4½ lines long with a wing somewhat longer and twice as broad.

North Coast Ranges, along ocean bluffs or scattered through the Redwood Belt, from near Fort Ross on the Sonoma coast northward and far northward to Oregon and Washington where it is abundant and attains its best development. In California it grows to greatest size in association with the Redwood east of Crescent City. Wood markedly odorous (whence "Stinking Fir"), producing a second grade lumber.

Refs.—ABIES GRANDIS Lindley, Penny Cycl. vol. 1, p. 30 (1833), type loc. mouth of Columbia River, *Douglas;* Sheldon, For. Wealth Oreg. p. 16 (1904).

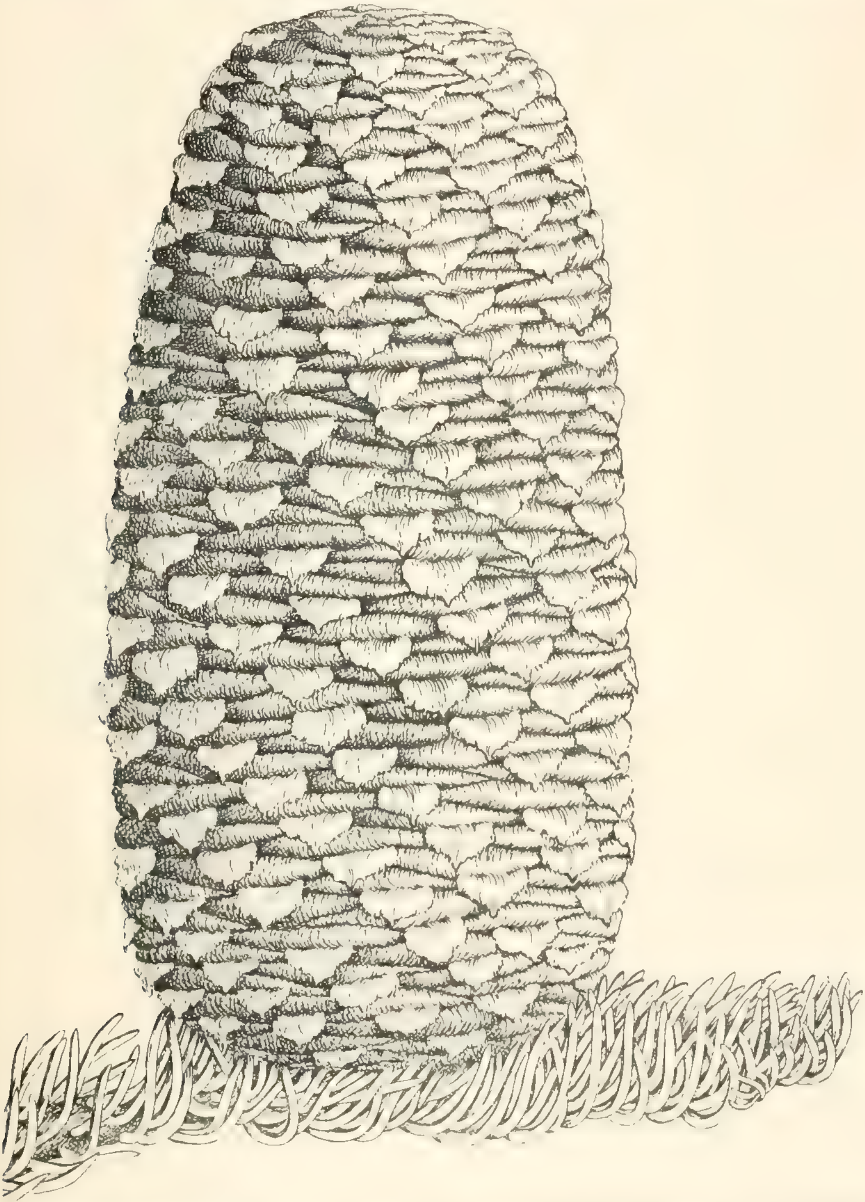

FIG. 10. ABIES MAGNIFICA Murr., the form with exserted reflexed bracts (VAR. SHASTENSIS Lemmon). The ordinary form bears similar cones but the bracts not visible. nat. size.

3. **A. magnifica** Murray. RED FIR. (Fig. 10.) Forest tree 60 to 175 or even 200 feet high, with a trunk 1 to 5 feet in diameter and a very narrow or cone-shaped crown composed of numerous horizontal strata of fan-shaped

sprays; bark on young trees whitish or silvery, on old trunks dark red, very deeply and roughly fissured, in section showing reddish brown areas set off by a sharply defined purple mesh; leaves ¾ to 1½ inches long, ridged above and below so as to be equally 4-sided, although more or less compressed, not contracted at base or scarcely so, acutish at apex, those on the under side of the branches spreading right and left, in the top of the tree more thickened, erect, incurved and hiding the upper side of the branch; staminate catkins dark red, about 3 lines long; cones, when young, beautiful dull purple objects, becoming brown when mature, 4 to 8 inches long, 2½ to 3½ inches in diameter, broadly oval in outline, the broad scales with upturned edges; bracts very variable in form and length, sometimes concealed beneath the scales, sometimes conspicuously exserted and reflexed, their terminal portion commonly transversely oblong, or broad with a short spreading awl-like point or pointless; seeds 7 lines long with a semi-flabelliform wing 8 lines long and 8 to 11 lines broad; cotyledons 9 to 13.

Mountain slopes and ridges: Sierra Nevada, 5,000 to 8,500 feet, from the Greenhorn Mts. northward to Lassen Peak and Mt. Shasta; thence ranging into southern Oregon, westward to Marble Mt., and southward along the Yollo Bolly range as far as Mt. Hull and Snow Mt. Wood straight, fine-grained, heavy and very durable. Large sticks from this tree are used as shaft timbers in Sierra Nevada gold mines. The most beautiful tree in the upper portion of the main timber belt of the Sierras.

Refs.—ABIES MAGNIFICA Murray, Proc. R. Hort. Soc. vol. 3, p. 318, f. 25-33 (1863), type loc. central Sierra Nevada; first discovered by Capt. J. C. Fremont. *A. nobilis* var. *magnifica* Kellogg, For. Trees Cal. p. 29 (1882); Masters, Jour. Linn. Soc. vol. 22, pp. 187, 189, figs. 20, 21 (1886).

4. **A. nobilis** Lindl. NOBLE FIR. Forest tree 80 to 250 feet high, with slender branchlets and roughly broken trunk bark; leaves on the lower branches flat, sharply and deeply grooved above, on upper branches rounded above and obscurely ridged below, erect, ¾ to 1½ inches long; cones oblong-cylindrical, 4 to 5 inches long, 2 to 2½ inches in diameter; scales surpassed and often wholly concealed by the reflexed spatulate bracts which are rounded and fimbriate and tipped with an awl-like point.

Coast Ranges and Cascades of Washington and Oregon, ranging south to the Siskiyou Mts. in southern Oregon and to Trinity Summit in California (W.L.J. no. 2079).

Refs.—ABIES NOBILIS Lindley, Penny Cycl. vol. 1, p. 30 (1833), type loc. Cascade Mts. just south of Columbia River, *Douglas.*

5. **A. venusta** Koch. SANTA LUCIA FIR. (Fig. 11.) Singular montane tree 30 to 75 or 100 feet high with a narrow crown abruptly tapering above into a steeple-like top; trunk ½ to 2½ feet in diameter, vested in light reddish brown bark, and bearing short slender declined or drooping branches nearly or quite to the ground; leaves stiff, sharp-pointed, dark green and nearly flat above, below with a white band on either side of the strong median ridge, 1¼ or mostly 1¾ to 2¼ inches long, 1 to 1½ lines wide, mostly 2-ranked; staminate catkins yellowish, fading reddish, broadly cylindrical, ¾ to 1⅛ inches long; ovulate catkins broadly oblong in outline, yellowish green, 1 to 1½ inches long; cones elliptic-oblong, 2½ to 4 inches long, 1½ to 2 inches thick, borne on peduncles ½ inch long which arise from a rosette-like cluster of broad thin scales of the winter bud; bracts wedge-shaped, truncate or

notched at summit, the midribs prolonged into a long-exserted bristle $1\frac{1}{2}$ to $1\frac{3}{4}$ inches long and $\frac{1}{2}$ line wide; seeds reddish brown, $3\frac{1}{2}$ lines long with a broad wing 4 to 5 lines long and rounded at apex.

Rocky mountain peaks and deep cañons, Santa Lucia Mts. Not found elsewhere. The known localities in the range from north to south are as follows: 1. Big Sur Cañon. 2. Millers Cañon, on watershed of the Carmel River. 3. Arrcyo Seco Cañon. 4. Twin Peaks and Cone Peak. 5. Cañon near Los Potranchos. 6. Cañada de Los Potranchos. 7. Bear Cañon near Punta Gorda. 8. Villa Cañon. 9. San Carpoforo Cañon. Restricted in range and also isolated from all other species in the genus, there being no other fir within 225 miles to the north, 140 miles to the east and 120 miles southeasterly.

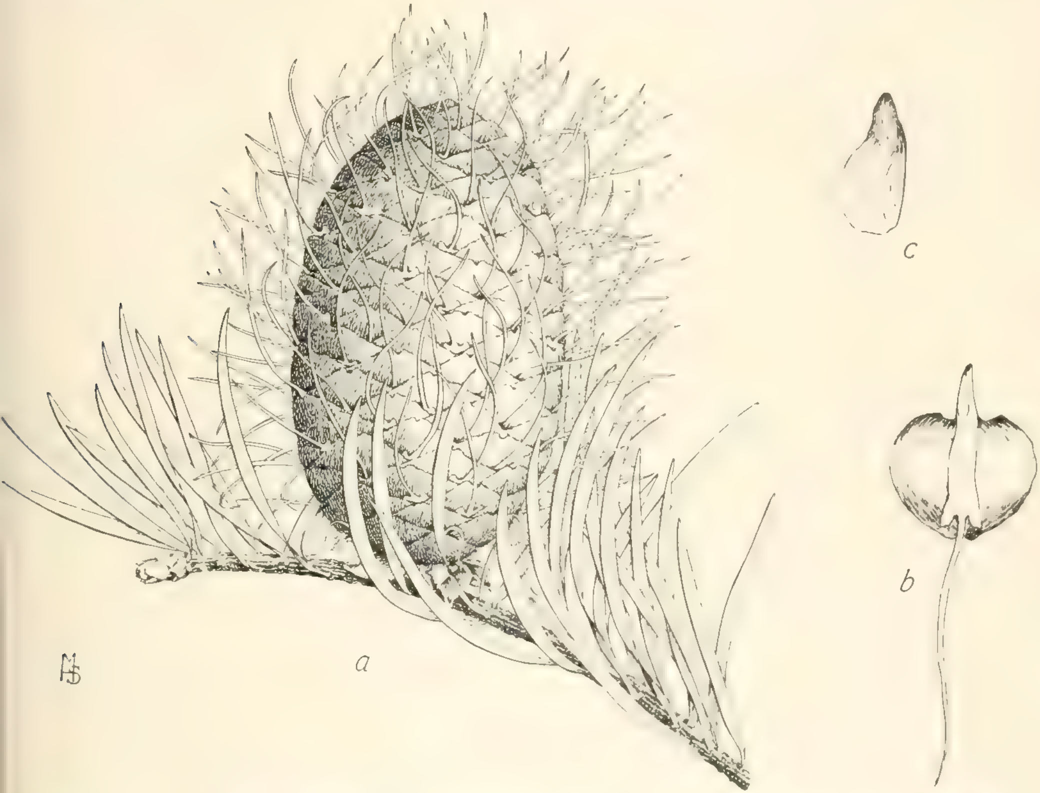

Fig. 11. Abies venusta Koch, remarkable for its long sharp-pointed leaves and long bristly bracts. *a*, Cone-bearing branchlet; *b*, scale and bract; *c*, seed. nat. size.

Refs.—Abies venusta Koch, Dendr. vol. 2, pt. 2, p. 210 (1873). *Pinus venusta* Douglas, Comp. Bot. Mag. vol. 2, p. 152 (1836). *P. bracteata* Don, Trans. Linn. Soc. vol. 17, p. 442 (1837). *Abies bracteata* Nuttall, Sylva, vol. 3, p. 137, t. 118 (1842); Engelmann in Bot. Cal. vol. 2, p. 118 (1880).

TAXODIACEAE. Redwood Family.

Trees with linear or awl-shaped alternate leaves. Staminate and ovulate catkins on the same tree. Staminate catkins small and cone like. Scales of the ovulate catkins spirally arranged, more or less blended with the bract, often spreading horizontally from the axis of the cone and developed into broad flattish summits. Ovules to each scale 2 to 9. Seeds not winged or merely margined.—Seven genera, widely scattered over the earth, each with 1 to 3 species. Taxodium (Bald Cypress), Cryptomeria (Japan Cedar), Cunninghamia, and Sciadopitys (Umbrella Pine) are cultivated in California.

Bibliog.—Gray, Asa, Sequoia and Its History (Proc. Am. Assoc. Adv. Sci. vol. 21, p. 1,—1872; Sci. Pap. vol. 2, p. 142,—1889). Big Tree, U. S. Div. For. Bull. no. 28 (1900). Redwood, U. S. Bur. For. Bull. no. 38 (1903).

SEQUOIA Endl. Redwood.

Tall trees with thick red fibrous bark and linear, awl-shaped, or scale-like leaves. Staminate catkins terminal, with many spirally disposed stamens, each bearing 2 to 5 pollen sacs. Ovulate catkins terminal, composed of many spirally arranged scales, each with 5 to 7 ovules at base. Cone woody, its scales divergent at right angles to the axis, widening upward and forming a broad rhomboidal wrinkled summit with a depressed center. Seeds flattened; cotyledons 4 to 6.—Two species. (Sequoia, a chief of the Cherokees, who invented an alphabet for his tribe.)

Leaves awl-shaped, ascending all around stem; cones 2 to 3¾ inches long; Sierra Nevada only ....1. *S. gigantea.*

Leaves linear, petioled, spreading in 2 ranks and forming a flat spray; cones ⅝ to 1¼ inches long; Coast Ranges only ....2. *S. sempervirens.*

1. **S. gigantea** Dec. Big Tree. Giant tree 100 to 325 feet high with columns 80 to 225 feet to the first limb and 5 to 30 feet in diameter at 6 feet above the ground; crown rounded at summit or much broken in age; bark red, deeply furrowed or fluted, ½ to 2 feet thick; leaves awl-like, 1 to 6 lines long, only the tips free, adherent below to the stem which they thickly clothe; cones maturing in the second autumn, red-brown, ovoid, 2 to 3¾ inches long, composed of 35 to 40 scales; scales with transversely rhomboidal summits and a centrally depressed umbo; seeds numerous, flattened, margined all around with a wing, ovatish or oblong in outline, 2½ to 3 lines long.

Western slope of the Sierra Nevada, 5,000 to 8,000 feet, from Placer Co. southward to Tulare Co., a longitudinal range of 250 miles but occurring in more or less widely disconnected and limited areas called "groves," thirty-two in number. The northern groves, i. e., north of King's River, are widely separated; the southern groves are less widely separated or even connected by scattered individuals and form an interrupted belt.

The north groves are as follows: 1. North Grove, Placer Co., 10 miles east of Michigan Bluff, 6 trees. 2. Calaveras Grove (type loc., Wm. Lobb), 51 acres, 101 trees. 3. Stanislaus Grove, 6 miles southeast of Calaveras Grove, 1,000 acres, 1,380 trees. 4. Tuolumne Grove, "Big Oak Flat"-Yosemite stage road, 1½ miles northwest of Crane Flat, 10 acres, 40 trees. 5. Merced Grove, Coulterville-Yosemite wagon road, 3 miles from Hazel Green, 20 acres, 33 trees. 6. Mariposa Grove, in Yosemite National Park, near Wawona, really consisting of two groves, 365 trees in upper grove, 182 trees in lower grove, one of these being the "Grizzly Giant"; 125 acres. 7. Fresno Grove, in Madera Co., near north line, 2,500 acres, 1,500 trees; many trees lumbered.

The south groves are as follows: 8. Dinkey Grove, in Sierra National Forest, Fresno Co., 50 acres, 170 trees. 9. Converse Basin Forest, Kings

River, Fresno Co., 5,000 acres, 12,000 trees; almost entirely lumbered. 10. Boulder Creek Forest, Kings River, Fresno Co., 3,200 acres, 6,450 trees; more or less lumbered. 11. General Grant Forest, near Millwood, Fresno Co., about 2,500 acres, 250 trees. 12. Redwood Cañon Forest, Redwood and Eshom creeks, Tulare Co., 3,000 acres, 15,000 trees. 13. North Kaweah Forest, North Fork Kaweah River, 500 acres, 800 trees. 14. Swanee River Grove, on Swanee River branch of Marble Fork Kaweah River, 20 acres, 129 trees. 15. Giant Forest, Marble Fork Kaweah River, 8,000 acres, 20,000 trees, about 5,000 large ones. 16. Redwood Meadow Grove, Middle Fork Kaweah River, 50 acres, 200 trees. 17. Harmon Meadow Grove, Middle Fork Kaweah River, 10 acres, 80 trees. 18. Atwell Forest, both sides of East Fork Kaweah River, 3 miles west of Mineral King, 1,500 acres, 3,000 trees; in large part lumbered. 19. Lake Cañon Grove, East Fork Kaweah River, 20 acres, 80 trees. 20. Mule Gulch Grove, East Fork Kaweah River, 25 acres, 70 trees. 21. Homer's Peak Forest, East Fork Kaweah River, 5,500 acres, 1,500 trees. 22. South Kaweah Forest, South Fork Kaweah River, 160 acres, 300 trees. 23. Dillon Forest, North Fork Tule River, 3,600 acres, 3,500 trees; large part lumbered. 24. Tule River Forest, Middle Fork Tule River, 15,000 acres, 5,000 trees; large part lumbered. 25. Pixley Grove, Middle Fork Tule River, 850 acres, 500 trees. 26. Fleitz Forest, Middle Fork Tule River, 4,000 acres, 1,500 trees. 27. Putnam Mill Forest, Middle Fork Tule River, 4,000 acres, 900 trees. 28. Kessing Groves, South Fork Tule River, 2,800 acres, 700 trees. 29. Indian Reservation Grove, South Fork Tule River, 1,500 acres, 350 trees. 30. Deer Creek Grove, South Fork Deer Creek, 300 acres, 100 trees. 31. Freeman Valley Forest, Kern River Basin, 1,000 acres, 400 trees. 32. Kern River Groves, Kern River Basin, 700 acres, 200 trees.

Big Tree prefers slopes, ridges or depressions where there is sufficient moisture but it may grow in bare granite as in Giant Forest. Commonly associated with White Fir, Incense Cedar, Yellow Pine and Sugar Pine. Reproduction fair in southern groves, especially on burned areas, mostly at a standstill in northern groves. Young trees of pyramidal outline with branches nearly or quite to ground; middle-aged trees clear of branches for 50 to 175 feet and with rounded summit to the crown; aged trees with broken crown, dead tip to axis, and more or less shattered side branches. Extreme age, 1,100 to 2,400 years. Wood similar to that of Redwood but more brittle, pink when freshly sawn.

Refs.—Sequoia gigantea Decaisne, Bull. Soc. Bot. Fr. vol. 1, p. 70 (1854); Shinn, Gard. & For., vol. 2, p. 614 (1889); Walker, Zoe, vol. 1, p. 198 (1890); Jepson in Elwes & Henry, Trees of Great Britain and Ireland, vol. 3, p. 704 (1908). *Wellingtonia gigantea* Lindley, Gard. Chron. 1853, p. 823. *Sequoia wellingtonia* Seeman, Bonplandia, vol. 3, p. 27 (1855); Sargent, Silva N. Am. vol. 10, p. 145, t. 536 (1896). Mammoth Trees, Williamson, Pac. R. Rep. vol. 5, p. 257, pl. 13 (1856).

2. **S. sempervirens** Endl. Redwood. (Figs. 12 and 13.) Tall tree 100 to 340 feet in height, with narrow crown, the branches horizontal or sweeping downward, especially the lower ones; bark cinnamon-red and fibrous, 3 inches to 2 feet thick; foliage reddish brown; leaves linear, spreading right and left so as to form flat sprays, ¼ to 1¼ (mostly ½ to ¾) inches long and 1 to 1¼ lines wide, or in the top of adult trees with short linear or awl-shaped leaves 1 to 5 lines long and strikingly similar to those of the preceding;

staminate catkins 3 lines long, with ovate crests and 4 pollen-sacs; cones oval, reddish brown, $\frac{5}{8}$ to $1\frac{1}{8}$ inches long and $\frac{5}{8}$ to $\frac{7}{8}$ inch broad, borne abundantly on the ends of branchlets mostly in the top of the tree, maturing in first autumn; scales 14 to 26; seeds narrowly margined, elliptic in outline, 2 lines long.

Fog belt of the California coast from the Santa Lucia Mts. northward to southwestern Oregon, forming an interrupted belt 450 miles long and 1 to 40 miles wide, most abundant on the western slope of the outer Coast Range. The two main bodies of Redwood occur in the North Coast Ranges north of the southern Sonoma line: 1. Humboldt-Del Norte area, the densest and most highly developed area, begins on Smith River, Del Norte Co., and extends southward through Humboldt forming splendid timber stands on Mad, Van Duzen, and main Eel rivers, but recedes from the coast just south of Eureka and follows the south fork of Eel River inland as far south as the vicinity of Philipsville. Excepting a few scattered patches, as at Briceland and White Thorn, there is a transverse break in the Redwood Belt in southern Humboldt Co. 2. Mendocino-Sonoma area, begins near the north line of Mendocino Co., follows the outer Coast Range southward as far as southern Sonoma (near Freestone), ranging inland to Willits, Cloverdale and Napa Valley and even crossing the Napa Range to the eastern slope of Howell Mt., the easternmost locality, 40 miles from the sea and on the watershed of the Sacramento River (Cf. Jepson, Fl. W. Mid. Cal. p. 24,—1901). South of Sonoma Co., the Redwood occurs in isolated or restricted areas as follows: Tocaloma to Mill Valley and Muir Woods in Marin Co.; Redwood Peak, Redwood Cañon and headwaters of San Leandro Creek in the Oakland Hills; Santa Cruz Mts., from near Half-Moon Bay to south bank of Pajaro River in San Benito Co., and east to Los Gatos, Norton and Saratoga cañons (lower limits 700 to 1,500 feet) and Palo Alto; Santa Lucia Mts., seaward slope from Tobie Dow's ranch to Salmon Creek Cañon (southernmost locality), chiefly confined to the narrow deep cañons. There are three groves in Oregon a few miles north of the California line. (Type loc. Santa Cruz, Menzies.)

Seed abundant but seed reproduction weak; reproducing abundantly and persistently by stump sprouts which form the barrier of poles or trees about an old stump known as a "Redwood circle." Mature trees are 500 to 1,400 years old. Its most common associates are Tan Oak, Douglas Fir, and Madroña, with a tangle of Huckleberry, Salal, and Thimbleberry on the forest floor. The yield is 10,000 to 60,000 feet board measure to the acre, but in Humboldt and Del Norte large areas on the river flats, nearly or quite pure, often yield 100,000 to 150,000 feet per acre, or sometimes as much as 400,000 feet; a yield of $2\frac{1}{2}$ million feet to the acre has been recorded. Wood light, soft, exceedingly straight and often fine-grained and used for numerous purposes in the California industries. Redwood lumber in this State has been of incalculable value in railroad, telegraph and dwelling construction, manufacturing, and general farm purposes. California might have spared her gold mines but not the resources of the Redwood Belt.

Refs.—SEQUOIA SEMPERVIRENS Endlicher, Syn. Con. p. 198 (1847); Purdy, Gard. and For. vol. 3, p. 235 (1890); Gibbons, Erythea, vol. 1, p. 161 (1893); Peirce, Proc. Cal. Acad. ser. 3, Bot. vol. 2, p. 83 (1901). *Taxodium sempervirens* Lambert, Pinus, vol. 2, p. 24, t. 7 (1828). *Sequoia gigantea* Endlicher, Syn. Conif. p. 198 (1847). Redwood, Nordhoff, N. Cal. Ore. & Sandwich Isl. p. 168 (1877); Sargent, Gard. & For. vol. 10, p. 41 (1897).

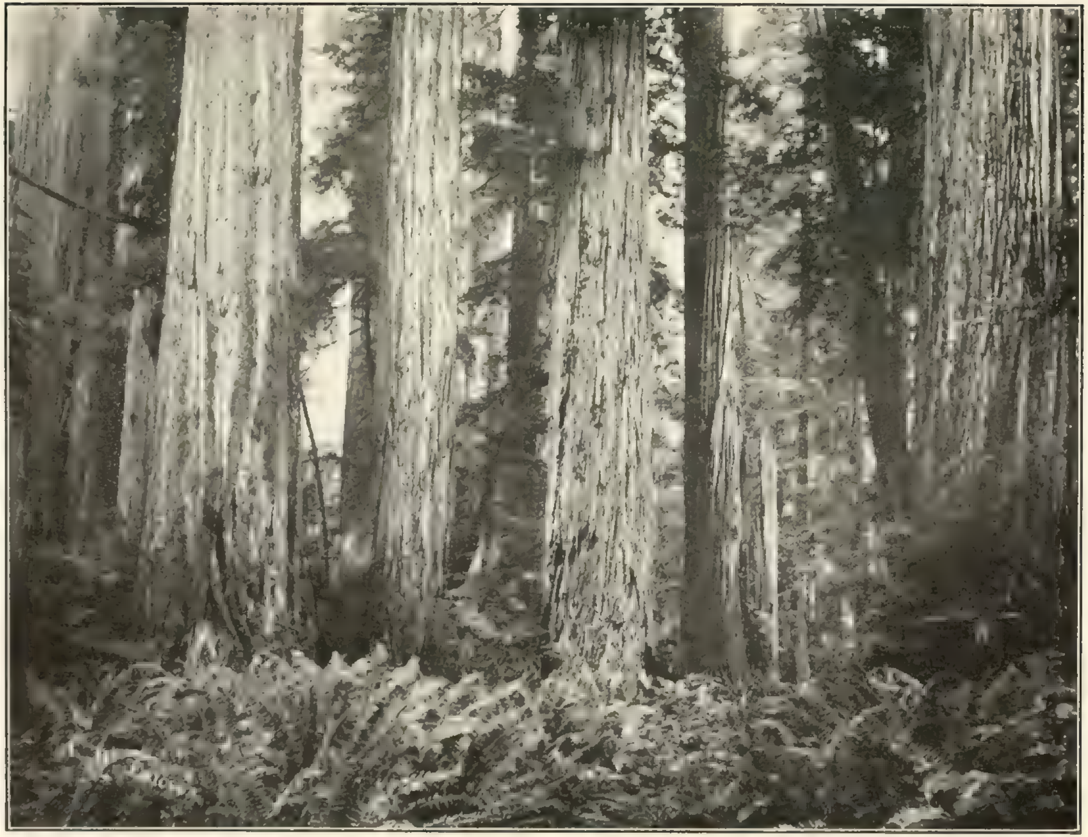

FIG. 12. SEQUOIA SEMPERVIRENS Endl. Virgin stand, Humboldt County, scaling 300,000 feet B. M. to the acre. Characteristic dense undergrowth of WOODWARDIA, VACCINIUM and other shrubs.

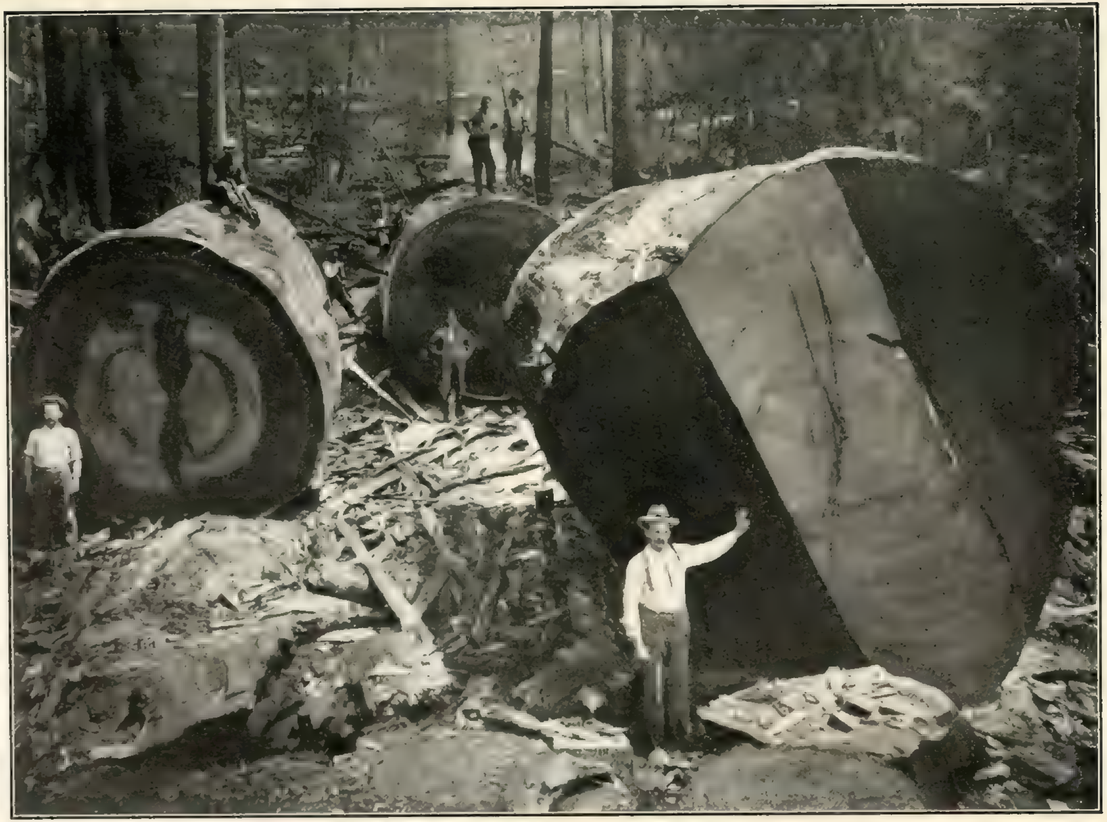

Fig. 13. Sequoia sempervirens Endl. Logging in the Vance Woods near Eureka; butt log in foreground 17 x 19 feet, from a tree which measured 150 feet to first limb.

CUPRESSACEAE. Cypress Family.

Trees or shrubs with opposite or whorled scale-like (or rarely linear) leaves thickly clothing the ultimate branchlets. Stamens and ovules in separate catkins terminal on the branchlets. Staminate catkins small, with shield-like stamens bearing 2 to 6 pollen-sacs. Ovulate catkins consisting of several opposite or whorled scales which bear at base 1 to several erect ovules. Cones dry or berry-like, of few scales; "scales" consisting (morphologically) of a completely blended scale and bract.—Nine genera, widely distributed over the earth. Thujopsis (Japanese Arborvitæ) is in cultivation with us.

Bibliog.—Hooker, J. D., Monterey Cypress (Gard. Chron. 1885, p. 176, fig.). Masters, M. T., A General View of the Genus Cupressus (Jour. Linn. Soc. vol. 31, p. 312,—1896).

Fruit a woody cone; stamens and ovules on same tree.

Branchlets flattened, disposed in flat sprays; leaves opposite, in 4 rows, the successive pairs unlike; cones maturing in first autumn; seeds 2 to each scale.

Scales of cones imbricated.

Cones pendent, scales 6, only the middle pair seed-bearing; seeds unequally 2-winged. ....1. Libocedrus.

Cones reflexed, scales 8 to 12, the 2 or 3 middle pair seed-bearing; seeds equally winged. ....2. Thuja.

Scales of cones peltate; seeds narrowly winged ....3. Chamaecyparis.

Branchlets cord-like, not in flat sprays; leaves opposite, in 4 rows, alike; cones maturing in second autumn; seeds acutely margined, many to each scale....4. Cupressus.

Fruit a berry; seeds 1 to 3 to each fruit; stamens and ovules on different trees; branchlets cord-like; leaves in whorls of 3 or opposite ....5. Juniperus.

1. LIBOCEDRUS Endl. Incense Cedar.

Aromatic trees with flattened branchlets disposed in one plane. Leaves scale-like, opposite, imbricated in 4 rows, the successive pairs unlike. Staminate and ovulate catkins terminal on separate branchlets. Staminate catkins with 12 to 16 decussately opposite stamens, each bearing 4 to 6 pollen-sacs. Ovulate catkins consisting of 6 scales with 2 ovules at the base of each. Cone maturing in one season, oblong, composed of 6 imbricated oblong scales, only the middle pair fertile. Seeds unequally 2-winged; cotyledons 2.—Eight species, 1 on the Pacific Coast of North America, 2 in Chile and 5 in the region from southwestern China to New Zealand. (Libas, a drop—of resin—and Cedrus, cedar.)

1. **L. decurrens** Torr. Incense Cedar. Forest tree 50 to 150 feet high with the strongly conical trunk very thick at base (1 to 6 feet in diameter) and gradually diminishing in size upwards; bark thick, red-brown, loose and fibrous, in age broken into prominent heavy longitudinal furrows; ultimate branchlets alternate, numerous, forming flattish sprays and clothed with adherent leaves as if jointed; leaves 1 to 4 lines long, in four ranks and in opposite pairs, coherent, adherent to the stem and free only at tips, those above and below obtuse but minutely pointed and forming a pair overlapped by the keel-shaped lateral pair; staminate catkins 1½ to 2 lines long, the pollen-sacs usually 5 to each scale which ends in a broad roundish crest; ovulate catkins borne singly at the ends of branchlets; cones red-brown, oblong-ovate when closed, ¾ to 1 inch long, consisting of 2 seed-bearing scales with 3 (apparently 1) sterile scales between them and often with 2 supplementary ones at base; seed-bearing scales broad and flattish but not thin; all the scales with a small triangular umbo at tip; seeds 4 lines long, margined on each side from

near the base to the apex by two very unequal wings; larger wing elliptical in outline and nearly as long as the scale.

Mountain slopes, cañons and plateaus, Sierra Nevada and Coast Ranges, northward in the Oregon Cascades to Mt. Hood, southward to all the higher ranges of Southern California and into Lower California. Attains its best development in the Sierra Nevada where it flourishes chiefly between 3,500 and 7,000 feet and is one of the four most abundant timber trees (Cf. description Yellow Pine). In the South Coast Ranges it occurs on the San Rafael, San Carlos and Santa Lucia ranges, but is not known from the Gabilan, Mt. Hamilton, Mt. Diablo and Santa Cruz ranges. In the North Coast Ranges it is found on Marble Mt. and Trinity Summit and from Weaverville southward along the Yollo Bolly and Mayacamas ranges as far as the neighborhood of Mt. St. Helena. Reproduces itself aggressively. Wood aromatic, reddish brown, close-grained, exceedingly durable. Also called Post Cedar, Red Cedar, White Cedar and Bastard Cedar.

Refs.—LIBOCEDRUS DECURRENS Torrey, Pl. Frem. p. 7, pl. 3 (1853), type loc. headwaters of the Sacramento River, *Fremont;* Jepson, Fl. W. Mid. Cal. p. 24 (1901).

2. THUYA L. ARBOR-VITAE.

Aromatic trees with scattered branches, the flattened branchlets disposed in one plane. Leaves scale-like, opposite, and imbricated in 4 rows, the successive pairs unlike, adnate with free tips. Catkins terminal. Staminate catkins with 4 to 6 stamens, each with 3 or 4 anther-cells under the subpeltate crests. Ovulate catkins with 8 to 12 erect scales, each with 2 erect ovules at base. Cones small, maturing the first autumn, reflexed; scales 8 to 12, thin-leathery, the lowest and uppermost pairs sterile. Seeds bordered by nearly equal lateral wings so as to be nearly round, their coats with minute resin-cells; cotyledons 2.—Four species, 2 in North America, and 2 in China and Japan. (Ancient Greek name for a resinous tree.)

1. **T. plicata** Don. CANOE CEDAR. Giant tree 80 to 190 feet high, of pyramidal outline, slender branches, drooping sprays and whip-like often nodding leader; trunk 3 to 16 feet in diameter at the ground but tapering rapidly above the base; bark cinnamon-red; branchlets repeatedly 2-ranked, forming flat sprays, thickly clothed with leaves which conceal the stem; leaves minute, in opposite pairs and of 2 kinds, those on the margin of the flat sprays keeled and acute at tip, those above and below flattish and triangular at apex; cones borne on short lateral branchlets, on opening turned downward beneath the spray, cinnamon color, oblong in outline when closed, ½ inch long; scales 9, the outer ones oblong or obovate, and much broader than the narrow inner ones; seeds winged all around and with a narrow notch at apex, the whole structure 3 lines long.

Outer Coast Range from the Bear River Mts. of Humboldt Co. northward along the coast of Oregon and Washington to southeastern Alaska, eastward to the Cascades, northern Idaho and Montana. Long attributed to Mendocino Co., but no exact station on record. Trees occur sparingly in California, and only 50 to 80 feet high. Wood aromatic, light, soft, remarkably durable, extensively manufactured into shingles. The northern coast Indians hewed their long war canoes out of a single log, wove the fibrous bark into clothing and made dwellings and household utensils out of the wood. Also called Oregon or Red Cedar.

Refs.—THUJA PLICATA Don in Lambert, Pinus, vol. 2, p. 19 (1824), type loc. Vancouver Island. *Archibald Menzies;* Sudworth, Rep. U. S. Dep. Agr. 1892, p. 328. *T. gigantea* Nuttall, Jour. Phil. Acad. vol. 7, pt. 1, p. 52 (1834); Engelmann in Bot. Cal. vol. 2, p. 115 (1880).

3. **CHAMAECYPARIS** Spach.

Trees or shrubs; leading shoot nodding; branchlets more or less flattened and in flat sprays; leaves opposite, in 4 rows, the successive pairs in ours unlike. Catkins and cones very similar to Cupressus. Stamens with usually 2 pollen-sacs. Ovules 2 to 5 at the base of each scale, the seeds winged, usually 2 (1 to 5). Cones maturing in the first autumn. Cotyledons 2.—Six species, 3 in North America and 3 in Japan. (Greek chamai, dwarf, and kuparissos, cypress.)

1. **C. lawsoniana** Parl. PORT ORFORD CEDAR. LAWSON CYPRESS. Forest tree 80 to 175 feet high, with straight shafts and narrow pyramidal crown of drooping branches ending in broad flat drooping fern-like sprays; bark brown or somewhat reddish, smooth on young trees, later parting on the surface into large loose thin shreds and finally in adult trees fissured longitudinally with the furrows continuous and separated by flat ridges; foliage fragrant; leaves adpressed, scale-like, thickly clothing the branchlets, disposed in opposite pairs, those above and below rhomboidal, glandular-pitted, and overlapped by the keel-shaped ones on the margin; staminate catkins crimson; cones globose, consisting of about 7 scales, 3 to 4 lines long; seeds 1½ to 2 lines long, narrowly wing-margined on each edge, the whole structure orbicular.

Moist hillsides or cañon bottoms from Coos Bay, Oregon, southward to Mad River and eastward to Halls Gulch, Trinity Co., and the Sacramento River Cañon from Slate Creek to Shasta Springs. Occurs in California only in isolated patches as at Quartz Creek and Shelly Creek bottom (Del Norte Co.), Klamath Range near Preston Peak, Three Creeks near Hupa Valley (W.L.J.), Trinity Center, and upper Trinity River between Coffee Creek and Scott Mts., with a few trees on Graves Creek (Benj. Macomber). The tallest of all cypresses. Wood very fine-grained, faint yellowish white, somewhat aromatic, highly valued as a cabinet wood but the supply limited. Also called Ginger Pine.

Refs.—CHAMAECYPARIS LAWSONIANA Parlatore in DeCandolle, Prodromus, vol. 16, pt. 2, p. 464 (1868). *Cupressus lawsoniana* Murray, Edin. New. Phil. Jour. n. ser. vol. 1, p. 292, t. 9 (1855). Type loc. Sacramento River Cañon, *Wm. Murray,* 1856.

C. NOOTKATENSIS Spach. Nootka Cedar. Yellow Cypress. Bark thin, irregularly fissured into flat ridges; branchlets not flattened; leaves alike, usually not glandular.—Northern Oregon to Alaska.

4. **CUPRESSUS** L. CYPRESS.

Trees or shrubs with the leaves small and appressed, scale-shaped and closely imbricated in 4 ranks on the ultimate branchlets, or awl-shaped on vigorous shoots. Staminate catkins terminal on the branchlets, with 3 to 5 pollen-sacs to each stamen. Ovulate catkins upon short lateral branchlets, the ovules numerous, erect, in several rows at the base of the scales. Cones globose to oblong, maturing in the second year, the shield-shaped scales fitting closely together by their margins, not overlapping, separating at maturity, their broad summits with a central boss or short point. Seeds acutely angled or with a narrow hard wing; cotyledons 2 to 5.—Northern hemisphere, 14 species. (Ancient Latin name from Greek, kuparissos.)

Umbos low, crescent shaped, upwardly impressed.
  Glands on leaves none or rare; maritime species.
    Seed small, black ....1. *C. goveniana.*
    Seed larger, brown ....2. *C. macrocarpa.*
  Glands on leaves present as dorsal pits; seeds brown..................3. *C. sargentii.*
Umbos conical, well-developed, spreading; leaves with conspicuous resin-bearing pits.
  Cones red-brown, 5 to 8 lines long; umbos typically incurved........4. *C. macnabiana.*
  Cones silvery or glaucous, 4 to 6 lines long; umbos short conical..........5. *C. bakerii.*

1. **C. goveniana** Gord. GOWEN CYPRESS. DWARF CYPRESS. Small shrub 1 to 20 feet high, rarely becoming a tree 75 feet high with the trunk bark brown, smoothish but superficially checked into freely interlocking ribbons ¾ inch broad; leaves without pits, rarely with lateral depressions; cones light brown, subglobose or oval, 6 to 8 lines long, rarely larger, with 4 pair of scales; umbo short, thin-edged, upwardly impressed; seeds black, angular or acutely margined, sometimes minutely warty, 1 to 1½ lines long.

Neighborhood of the ocean: Monterey (type loc., Theo. Hartweg); Mendocino White Plains from Mendocino City north to Ft. Bragg. Miniature forests are found on the Mendocino White Plains, where the alkaline soil rests on a sandstone hardpan 1 or 2 feet below the surface; these tiny forests consist of dwarf canes 1 to 5 feet high, unbranched or with only a few short foliage branchlets, and are a remarkable feature of the region. Bushy shrubs 6 to 12 feet high and slender poles 15 to 25 feet high also occur in the same locality, as well as a few trees 50 to 75 feet high and 2½ to 3 feet in trunk diameter. At Monterey hundreds of cone-bearing dwarfs 1 to 2 feet high are scattered in the forest which extends southward and westward from Huckleberry Hill.

Refs.—CUPRESSUS GOVENIANA Gordon, Jour. Hort. Soc. Lond. vol. 4, p. 295 (1849). *C. goveniana* var. *pygmaea* Lemmon, Handb. West. Am. Conif., p. 77 (1895). *C. pygmaea* Sargent, Bot. Gaz. vol. 31, p. 239 (1901). *C. goveniana* var. *parva* Lemmon, Sierra Club Bull. vol. 4, p. 116 (1902).

2. **C. macrocarpa** Hartw. MONTEREY CYPRESS. Littoral tree 15 to 20 feet high with trunk 1 to 3 feet in diameter; crown regular, conical, or when wind-blown exceedingly distorted and irregular; ultimate branchlets numerous, fine and terete, densely clothed with triangular scale-like leaves; leaves ½ to 1½ lines long; staminate catkins ovate or subglobose, 1 to 2 lines long, borne at the ends of the ultimate branchlets; ovulate catkins greenish, composed of about 7 pairs of broadly ovate thinnish scales; cones dull brown, broadly oblong or subglobose, 1 to 2 inches long; scales flat-topped, with a central curved thin-edged ridge-like umbo; seeds 1 to 2 lines long, narrowly wing-margined but irregularly shaped from crowding in the cones and with a minute white lanceolate attachment scar at base.

Two groves on sea coast near Monterey. The Point Cypress Grove extends from Point Cypress south about two miles to Pescadero Point at Carmel Bay, occupying a strip a few hundred yards wide or with a few trees scattered farther inland. The Point Lobos Grove occurs on Point Lobos south of Carmel Bay. Many trees stand on the bold headlands or cling to the rocky sea-cliffs and are carved into picturesque outlines by the violent winds from the Pacific. The flattened or board-like stems are a characteristic feature of these trees. Monterey Cypress is cultivated in many parts of the world and is highly valued as a windbreak in California since it is of rapid growth and affords a perfect shelter.

Refs.—CUPRESSUS MACROCARPA Hartweg in Gordon, Jour. Hort. Soc. Lond. vol. 4, p. 296, fig (1849), vol. 2, p. 187 (1847); Hooker, Gard. Chron. 1885, p. 176, fig.

3. **C. sargentii** Jepson n. nom. Sargent Cypress. Shrub or small tree with compact crown, 8 to 15 feet high; bark grayish brown and fibrous; leaves with a closed dorsal pit, rarely with lateral depressions, about ½ line long; cones globose, often congested in heavy clusters, shortly peduncled, 8 to 11 lines in diameter; scales 6 or 8, with a very small low upwardly impressed crescent-shaped umbo; seeds brown, acutely margined, 1½ to 2 lines long.—(Frutex vel arbor parva 8 ad 15 ped. alta; cortex cinereofuscus fibratusque; folia circa ½ lin. longa cum alveolis dorsuali clauso, infrequenter cum cavis lateralibus; coni globosi sæpe valde aggregati, breviter pedunculi, 8 and 10 lin. in diametro; squamæ 6 ad 8 cum umbone paululo, brevi, lunato atque de infra impresso; semina fusca acute marginata 1½ ad 2 lin. longa).

Dry mountain slopes: Mayacamas Range, W.L.J. no. 3027 (type); west side Mt. Tamalpais; Cedar Mt., Alameda Co.; Bonny Doon, Santa Cruz Mts.; Los Burros Trail, Santa Lucia Mts. Localities few and isolated.

Refs.—Cupressus sargentii Jepson. *C. goveniana* Engelmann in Bot. Cal. vol. 2, p. 114, exclusive of Monterey plants; Sargent, Silva N. Am. vol. 10, p. 107, t. 527 (1896); Jepson, Fl. W. Mid. Cal. p. 25 (1901).

4. **C. macnabiana** Murr. McNab Cypress. Shrub or tree most commonly 15 to 25 but even 40 feet high with trunk ¼ to nearly 2 feet in diameter; bark light gray and very smooth; foliage pungently fragrant with a spicy odor; leaves ½ line long with a conspicuous resin pit or white gland on the back towards the apex, often slightly glaucous; cones globose, clustered, short-peduncled, 5 to 8 lines in diameter, reddish or grayish brown; scales 6 to 8 with strong conical umbos, the uppermost pair very prominent or horn-like and incurved; seeds brown, 1½ to mostly 2 lines long.

Samuels Springs (Napa Co.) to Coyote Valley; Red Mt., Bartlett Creek and northward to Whiskeytown, Shasta Co. (type loc.), and near Dobbin and Magalia in northern Sierra foothills.

Refs.—Cupressus macnabiana Murray, Edin. New Phil. Jour. vol. i, p. 293, pl. 11 (1855); Jepson, Fl. W. Mid. Cal. p. 25 (1901).

5. **C. bakerii** Jepson n. sp. Modoc Cypress. Shrub or becoming a small tree 25 feet high with red-brown bark and very slender branchlets; leaves with a distinct resin pit on middle of keeled back; staminate catkins 1 line long or less; cones globose, satiny or glaucous, 5 to 6 lines in diameter; scales 3 pair or with a fourth smaller upper pair; umbos abruptly drawn to a short point, either nipple-like or compressed, straight or slightly curved; seeds brown, 1½ lines long, narrowly wing-margined.—(Frutex vel arbor parva 25 ped. alta; cortex rufo-fuscus; ramusculi tenuissimi; folia glandula distincta resiniferaque in medio carinato dorso; amenta staminata 1 lin. vel minus longa; coni globosi, nitidi vel glauci, 4 ad 6 lin. in diametro; tria paria squamarum vel quartum par minor supra; umbones abrupte contracti ad apicem vel papillati vel compressi, recti vel leniter unci; semina fusca 1½ lin. longa, anguste marginata ala).

Lava beds of southeastern Siskiyou and southwestern Modoc cos. Between Little Hot Spring Valley and Hills Farm, it is associated with Juniper, Yellow Pine and Knob-cone Pine (M. S. Baker).

5. JUNIPERUS L. Juniper.

Trees or shrubs. Leaves in whorls of 3 or opposite, scale-like, imbricated, closely appressed and adnate to the branchlets or linear-subulate and spreading. Stamens and ovules on separate trees. Staminate catkins with many stamens, each with 2 to 6 pollen-sacs. Ovulate catkins of 3 to 6 succulent coalescent scales, each bearing 1 or 2 ovules. Cones fleshy and berry-like, ripening the second year, in ours 1 to 3-seeded; cotyledons 2 to 6.—Northern hemisphere, about 30 species. (Ancient Latin name.)

Catkins axillary; leaves linear-subulate, spreading, white-glaucous above; subalpine shrub. .... 1. *J. communis.*

Catkins terminal on short branchlets; leaves scale-like, closely appressed to the branchlets, in whorls of 3 or opposite.

- Berries reddish brown, oblong; cotyledons 4 to 6; medium altitudes, chiefly Coast Ranges. .... 2. *J. californica.*
- Berries blue-black, globose or subglobose.
    - Cotyledons 4 to 6; desert ranges........ 3. *J. utahensis.*
    - Cotyledons 2; high Sierras .... 4. *J. occidentalis.*

1. **J. communis** L. Dwarf Juniper. Low or prostrate alpine shrub, 1 foot high or less, forming patches a few feet in diameter; leaves rigid, linear or lanceolate, acute, cuspidate, 3 to 6 lines long, 3 (rarely 2) at a node with very short internodes, spreading or ascending, green below, white-glaucous above; staminate catkins 1½ to 2¼ lines long, their scales broad and abruptly contracted into a short subulate point; berries globose, bright blue, covered with white bloom, 1½ to 2½ lines long.

Sierra Nevada, 8,000 to 10,000 feet, from Mono Pass north to Mt. Shasta, and west to Trinity Co. Widely distributed in the United States in the high mountains, ranging far north to Alaska and Greenland, and in the Old World.

Ref.—Juniperus communis Linnæus, Sp. Pl. 1040 (1753).

2. **J. californica** Carr. California Juniper. Usually a shrub, much-branched from the base, 2 to 20 feet high, or occasionally a tree 40 feet in height; bark brown or ashen gray, the thin outer layers becoming at length very loose and shreddy; leaves in 3s, ovate, acute, each with a dorsal pit towards the base, crowded on the ultimate branchlets or occasionally free and subulate, ½ to 1 line long; ovulate catkins consisting of 4 to 6 scales; berries reddish or brownish, almost smooth or roughened with a few small projections or horn-like processes, covered with a dense white bloom, subglobose or oblong, 4 to 7 lines long, with dry fibrous sweet flesh and 1 to 3 seeds; seeds ovate, acute, brown with a thick smooth but angled or ridged polished bony shell, 3 to 5½ lines long; embryo 2⅓ lines long with 4 to 6 cotyledons.

Dry hills or arid mountain slopes; North Coast Ranges from Mt. St. Johns southwesterly to the hill country west of Scott Valley, Lake Co. (Carl Purdy); South Coast Ranges from Mt. Diablo along the Mt. Hamilton Range to Tres Pinos, San Carlos Range and Priest Valley, southward to Matilija Creek, eastward to Fort Tejon and thence northward in the Sierra Nevada to Kernville and the Merced River (type loc., 1,000 feet altitude). Abundant on desert slopes of Sierra Madre and San Bernardino Mts. and southward into Lower California. Attributed to the "Lower Sacramento" in the Botany of the California where it does not exist, but the reference has been copied by many later authors.

Refs.—Juniperus californica Carriere, Rev. Hort. 1854, p. 352, fig.; Palmer, Am. Nat. vol. 12, p. 593 (1878); Jepson, Fl. W. Mid. Cal. p. 25 (1901).

3. **J. utahensis** Lemmon. Desert Juniper. Small or stunted shrub 3 to 15 (or 20) feet high; very similar to the preceding, but distinguishable by its more slender branches, its usually glandless leaves which are acute and sometimes in whorls of 2, and its usually globose 1-seeded berries; berries

blue-black with a whitish bloom and 4 to 5 lines long, resembling the next but the cotyledons 4 to 6.

Desert ranges of California east of the Sierra Nevada: White and Inyo mts., Panamint Range, Grapevine and Providence mts., and north to Virginia City. Widely distributed in Nevada, Arizona and Utah.

Refs.—JUNIPERUS UTAHENSIS Lemmon, Rep. Cal. Board For. vol. 3, p. 183, t. 28, fig. 2 (1890). *J. californica* var. *utahensis* Engelmann, Trans. St. Louis Acad. vol. 3, p. 588 (1877); Watson, Bot. Cal. vol. 2, p. 113 (1880).

4. **J. occidentalis** Hook. SIERRA JUNIPER. Subalpine tree 10 to 25 or sometimes 65 feet high; trunk 1 to 5 feet in diameter, the bark dull red, flaking off in thin scales or shreds; branchlets alternate, the ultimate ones small, numerous, congested; leaves in 3s, ½ line long, ovate-triangular, bearing on the back a more or less distinct gland or pit, or on vigorous shoots subulate and 1 to 2 lines long; staminate catkins 1½ to 2 lines long, 6 pollen-sacs under each peltate scale; berries globose to ovoid, blue-black with a whitish bloom, 3 to 5 lines long, almost smooth or minutely umbonate, with resinous juicy flesh and 2 seeds (rarely 1 or 3); seeds flat on the face, the convex back with 3 to 5 resinous-glandular pits; embryo ¾ to 1 line long, with 2 cotyledons.

Timber line tree in Sierra Nevada, 6,000 to 10,000 feet in southern part and 3,500 to 7,000 feet in northern part, occurring as scattered individuals or in open groves, often found on the bare granite; trunks tapering strongly upward. Ranges south to San Bernardino Mts. and San Pedro Martir, north to Mt. Shasta, thence west to Trinity Mts. and south to South Yollo Bolly (W.L.J., 1897). Extends north through eastern Oregon to Idaho.

Refs.—JUNIPERUS OCCIDENTALIS Hooker, Fl. Bor. Am. vol. 2, p. 166 (1839), type loc. Columbia River basin, *Douglas;* Muir, Mts. of Cal. p. 204 (1901).

TAXACEAE. YEW FAMILY.

Trees or shrubs with linear flat 2-ranked leaves. Staminate and ovulate organs on different trees. Stamen clusters arising from axillary buds on under side of branchlets, the filaments monadelphous in a column. Ovules solitary and terminal on the branchlets. Seed with a bony coat, set in a fleshy disk or completely enveloped by it. Embryo small, embedded in abundant endosperm; cotyledons 2.

Fruit scarlet; stamens 8 to 12 in a cluster; leaves ½ to ⅔ inch long, acute at apex, without resin-canal ....1. TAXUS.
Fruit green or purplish; stamens 24 to 32 in a cluster; leaves 1¼ to 2½ inches long, stiffish, bristle-pointed, the resin-canal central ....2. TORREYA.

1. TAXUS L. YEW.

Trees or shrubs with leaves bluntish or merely acute. Stamens 8 to 12 in a cluster, the 4 to 9 pollen-sacs borne under a shield-like crest. Ovule seated upon a circular disk which in fruit becomes cup-shaped, fleshy and red, surrounding the bony seed, the whole berry-like.—Northern hemisphere, 1 species and 6 subspecies. (Ancient Latin name of the yew.)

1. **T. brevifolia** Nutt. WESTERN YEW. Small tree 15 to 30 feet high, rarely exceeding 40 feet, irregular in outline, the branches of unequal length and standing at various angles but tending to droop; trunk ½ to 2 feet in diameter, with a thin red-brown smooth bark which becomes shreddy as it flakes off in thin and rather small pieces; leaves linear, acute at apex, shortly petioled, flat with midrib in relief above and below, 3 or mostly 6 to 8 lines

long, 1 line wide, spreading right and left in flat sprays; stamen clusters globose, 1 to 1½ lines long; seeds borne on the under side of the sprays and when mature set in a fleshy scarlet cup, the whole looking like a brilliantly colored berry, 5 or 6 lines long.

Along deep cañon streams or moist shady bottoms: Sierra Nevada from Lassen Peak southward to Tulare Co.; cañons below south base of Mt. Shasta; north Coast Ranges (chiefly between 1,000 and 2,500 feet) from the Klamath Range and the Siskiyou Mts. south to Three Creeks (Humboldt Co.), Sherwood, Snow Mt. and Mt. St. Helena; Santa Cruz Mts., Laguna Creek (Dr. C. L. Anderson). Reported in the Santa Lucia Mts. but no definite locality on record. Its general range in California is essentially that of Douglas Fir but it occurs only in widely sundered localities of very small area and is not abundant in any locality. Beyond our borders ranging north to southern tip of Alaska and eastward to the continental divide in western Montana. Wood very hard, dense, springy and durable; used for machine bearings and by the native tribes for their best bows.

Refs.—TAXUS BREVIFOLIA Nuttall, Sylva, vol. 3, p. 86, t. 108 (1849), type loc. near mouth of Columbia River, *Nuttall;* Jepson, Fl. W. Mid. Cal. p. 17 (1901); Goddard, Univ. Cal. Publ. Am. Archae. vol. 1, p. 32 (1903).

2. **TORREYA** Arn.

Trees with rigid sharp-pointed leaves. Stamen clusters solitary in the adjacent leaf axils, borne on 1-year-old branches, made up of 6 to 8 whorls of stamens, 4 stamens in a whorl, each filament with 4 pollen-sacs without crests. Ovule completely covered by a fleshy aril-like coat, the whole becoming drupe-like in fruit. Seed with thick woody outer coat, its inner layer irregularly folded into the white endosperm.—Four species, 1 in California, 1 in Florida, and 2 in China and Japan. (Named for John Torrey of Columbia College, long identified with western botany and who first visited California before the days of the Overland Railroad.)

1. **T. californica** Torr. CALIFORNIA NUTMEG. Handsome dark green tree 15 to 90 feet high, the trunk ½ to 3 feet in diameter and clothed in smoothish thin dark bark; leaves rigid, 1¼ to 2½ inches long, 1½ lines wide, flat, dark green above, yellowish green beneath and with two longitudinal glaucous grooves, linear or somewhat tapering upward, the apex armed with a stout short bristle, twisted on their short petioles so as to form a 2-ranked flat spray; stamen clusters whitish, globose, about 3 lines long, crowded on the under side of the branches; fruit elliptical in outline, resembling a plum or olive, green in color or when ripe streaked with purple, 1⅛ to 1¾ inches long; flesh thin and resinous; shell of the seed more or less longitudinally grooved; embryo minute (1 line long), placed at the upper end of the seed; endosperm copious, with irregular incisions filled by the inner coat, giving it a marbled appearance so that in cross-section the seed resembles the true nutmeg of commerce.

Coast Ranges: Big River and Melburne, Mendocino Co.; Bartlett Springs; Mayacamas Range from the Terraces east of Ukiah south to Mt. St. Helena; Duncans Mills; Bolinas Ridge from Tocaloma to Mt. Tamalpais; Santa Cruz Mts. from La Honda to Archibald Creek (W.L.J.) and southeasterly to Hume, Norton and Saratoga cañons between 1,000 and 2,000 feet (R. L. Pendleton). Sierra Nevada: Lassens Butte, Yuba and Feather rivers, and reported from

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Pitt River; American River to Merced River (near Yosemite Valley) and south to South Fork Kaweah.

Refs.—TORREYA CALIFORNICA Torr. N. Y. Jour. Pharm. 3: 49 (1854), type loc. headwaters Feather and Yuba rivers; Jepson, Silva Cal. 167, pl. 53 (1910). *Tumion californicum* Greene, Pitt. 2: 195 (1891); Sargent, Silva N. Am. 10: 59, t. 513 (1896); Sudworth, Trees Pac. Coast, 191 (1908).

GNETACEAE. GNETUM FAMILY.

Woody plants without resin, of very diverse habit. Leaves opposite or ternate. Catkins unisexual, with imbricated bracts. Stamens 1, or several and monadelphous, set within a membranous calyx-like perianth, the perianths sessile in the axils of the bracts. Ovule solitary, surrounded by a very small urn-shaped perianth and produced at apex into an exserted style-like process (micropyle), the whole sessile at the summit of the catkin and subtended by its bracts. Embryo axile in endosperm; cotyledons always 2.—Genera 3, the remarkable Welwitschia of South Africa, Gnetum of the tropics, and Ephedra.

1. EPHEDRA L.

Equisetum-like shrubs with slender long-jointed stems, opposite or fascicled branches and scale-like leaves. Leaves more or less connate, sheathing the stem, at length splitting to the base. Staminate and ovulate catkins on different shrubs. Stamens 2 to 8, united into a column. Ovulate perianth indurated in fruit, perforated only for the passage of the micropyle.—Species 30, desert regions of both eastern and western hemispheres. (Greek ephedra, the name used by Pliny for the horse-tails.)

Scales and bracts in 2's; bracts connate at base; ovulate catkins (and sometimes the staminate) on peduncles ½ to 4 lines long.
  Branches bright or yellowish green, erect and broom-like....................1. *E. viridis.*
  Branches pale or glaucous, divergent....................................2. *E. nevadensis.*
Scales and bracts in 3's; bracts distinct; ovulate catkins sessile or nearly so; branches clustered, erect.
  Fruiting catkin subglobose, 3 to 4 lines long............................3. *E. californica.*
  Fruiting catkin slender-ovate, 5 to 6 lines long..........................4. *E. trifurca.*

1. **E. viridis** Cov. Erect green shrub 1½ to 3 feet high, with numerous broom-like muriculate branches; fruiting bracts green, firm, with narrow scarious edge; fruits 1 or usually 2 in a place, with flat faces and strongly convex or carinate backs, 3½ to 4 lines long.

Mountain slopes (5000 to 7000 feet alt.) of the desert ranges about the Mohave Desert, Owens Valley and Death Valley, north to the White Mountains and east through Nevada and Arizona to southwestern Utah. Also Ft. Tejon.

Refs.—EPHEDRA VIRIDIS Cov. Contrib. U. S. Nat. Herb. 4: 220 (1893), type from Coso Mts., Inyo Co., *Coville* 923.

2. **E. nevadensis** Wats. Erect olive-colored shrub ½ to 2 feet high; branches somewhat scabrous, divergent; scales sheathing, at length mostly deciduous; fruiting bracts ovate or round ovate, firm, scarious on edges, 4 to 6 pairs; fruit exserted, 3 or 4 lines long, 3-ridged or trigonous, or, when 2 in a place, with more or less flat faces and strongly convex or carinate backs.

Desert valleys of the Mohave and Colorado deserts (2500 to 4500 feet alt.), north to Honey Lake Valley and northern Nevada (Pyramid Lake, *Lemmon*), south into Mexico and Lower California, and east through southern Nevada to Utah. Also Kern Valley and upper San Joaquin Valley.

Refs.—EPHEDRA NEVADENSIS Wats. Proc. Am. Acad. 14: 298 (1879), Bot. Cal. 2: 108 (1880). *E. antisyphilitica* Wats. U. S. Expl. 40th Par. 5: 328, pl. 39 (1871), not C. A. Mey.

3. **E. californica** Wats. Stems decumbent or spreading, with numerous

erect branches, 1½ to 3 feet high; fruiting bracts reddish or brownish, submembranous, in 4 or 5 whorls, reniform-orbicular, entire, with a short broad claw; fruit ovate, included, 4-angled, 2½ to 3 lines long.

Mohave and Colorado deserts, north to Cantua Creek (western Fresno Co.), west to San Diego and south into Lower California.

Refs.—EPHEDRA CALIFORNICA Wats. Proc. Am. Acad. 14: 300 (1879), type loc. San Diego, *Dr. Palmer;* Bot. Cal. 2: 109 (1880); Abrams, Bull. N. Y. Bot. Gard. 6: 333 (1910).

4. **E. trifurca** Torr. Erect light- or yellowish-green shrub 1½ to 5 feet high, with spinosely tipped straight branches; scales conspicuously sheathing, 3 to 6 lines long; staminate catkins on a very short peduncle; ovulate catkins nearly sessile, of 8 to 10 whorls of bracts; bracts large, very thin, scarious, round-cordate, clawed, with reddish centres; fruit solitary, slender, 4-sided, 6 lines long.

Mohave River at Daggett acc. to Coville (Bot. Death Valley, 220); Yuma, Arizona, *Parish*, in litt.; east to Colorado and Texas, and south into Mexico.

Refs.—EPHEDRA TRIFURCA Torr. in Emory, Mil. Rec. Ft. Leavenworth to San Diego, 153 (1848), type loc. between the Del Norte and Gila rivers.

E. TORREYANA Wats. Erect whitish or pale shrub 1 to 3 feet high, the branches often somewhat flexuous; scales short, 1 to 2 lines long; catkins nearly sessile; ovulate catkins of 6 to 8 whorls of bracts; bracts yellowish or greenish, very thin, very broad, clawed; fruit solitary or in 3's, oblong-lanceolate, scabrous.—Moapa, southern Nevada, *Kennedy*, and east to Colorado. Credited to California by Nelson (Man. Rocky Mts. 31).

ANGIOSPERMS

Trees, shrubs or herbs. Sexual reproductive organ called a flower, typically consisting of a short axis bearing circles of calyx and corolla parts, stamens and pistils. Calyx or corolla or both often absent, and stamens and pistils often in different flowers. Ovules always enclosed in a sac or ovary.

MONOCOTYLEDONS

Leaves parallel-veined. Stems with the vascular bundles scattered irregularly through them, without central pith or concentric woody layers. Flowers with the parts usually in 3's or 6's, never in 5's. Embryo with one cotyledon.

TYPHACEAE. CAT-TAIL FAMILY.

Marsh or aquatic perennial herbs, the solid cylindric jointless stems from creeping rootstocks and bearing long linear alternate leaves. Flowers monoecious, crowded in dense cylindrical spikes, without perianth. Ovary 1-celled, 1-ovuled, with a slender style and elongated lateral stigma, becoming in fruit a seed-like nutlet. Embryo straight, embedded in copious endosperm.—All continents, 1 genus.

Bibliog.—Graebner, P., Typhaceae (Engler, Pflzr. teil 4, abt. 8,—1900). Morong, T., Typha (Bull. Torr. Club, vol. 15, pp. 1-8,—1888).

1. TYPHA L. CAT-TAIL.

Stems tall, simple, ending above in a long spike, the pistillate portion below, the staminate portion above. Stamens seated directly on the axis, intermixed with long bristle-like hairs. Ovaries minute, pedicellate; pedicels bearing clavate bristles which envelope the very small nutlets in a copious down.—Nine species. (Ancient Greek name of the Cat-tail.)

Staminate and pistillate portions of spikes contiguous, rarely separated; pistillate flowers without bractlets. . . . . 1. *T. latifolia.*

Staminate and pistillate portions of spikes usually separated by a small interval; pistillate flowers with bractlets.... .. ..2. *T. angustifolia.*

1. **T. latifolia** L. COMMON CAT-TAIL. Stout, 3½ to 6 feet high; leaves very long, flat, sheathing at the base, ¼ to 1 inch broad; spike 7 to 13 inches long; pistillate portion of spike without bractlets; stigma rhombic-lanceolate; pollen-grains in 4's; fruiting spike dark brown or blackish, 10 to 12 lines thick.

Common in marshes and marshy places by creeks: San Francisco Bay region, Great Valley and Sierra Nevada foothills, south to southern California, north to Washington. Throughout north temperate zone.

Refs.—TYPHA LATIFOLIA L. Sp. Pl. 971 (1753); Wats. Bot. Cal. 2: 188 (1880); Jepson, Fl. W. Mid. Cal. 96 (1901).

2. **T. angustifolia** L. Stems slender, 3 to 8 feet high; leaves 3 to 6 lines broad, somewhat convex on the back; pistillate flowers with a hair-like bractlet dilated at apex and a linear stigma; pollen-grains simple; fruiting spikes light or dark brown, 5 to 6 lines thick.

Marshes: Los Angeles, San Bernardino, south into Lower California, and east and northeast through the desert regions. North and South America, Europe, Asia, north Africa.

Refs.—TYPHA ANGUSTIFOLIA L. Sp. Pl. 971 (1753); Wats. Bot. Cal. 2: 189 (1880); Abrams, Fl. Los Ang. 8 (1904). *T. bracteata* Greene, Bull. Cal. Acad. 2: 413 (1887), type from Santa Cruz Island, *Greene*. *T. domingensis* Rohrb.; Brandegee, Zoe, 1: 146 (1890).

SPARGANIACEAE. BUR-REED FAMILY.

Marsh or aquatic plants with terete stems from creeping rootstocks, alternate long-linear 2-ranked leaves and monoecious flowers in globose heads. Ovary 1 to 2-celled. Fruit consisting of obovoid or spindle-shaped nutlets, 1 to 2-seeded.—One genus.

Bibliog.—Graebner, P., Sparganiaceae (Engler, Pflzr. teil 4, abt. 10,—1900). Morong, T., Sparganium (Bull. Torr. Club, vol. 15, pp. 73-81,—1888).

1. **SPARGANIUM** L. BUR-REED.

Perennials with fibrous roots and horizontal rootstocks. Heads scattered along the upper portion of the simple or sparingly branched stem; lower heads pistillate, with leaf-like bracts; upper heads staminate. Stamens with minute scales interposed, their filaments slender and elongated. Ovaries surrounded by 3 to 6 linear-subulate scales forming a sort of calyx.—North temperate and arctic zones, and New Zealand, 15 species. (Sparganion, the Greek name, diminutive of sparganon, a swaddling-band, on account of the ribbon-like leaves.)

Inflorescence compound; pistillate flowers sessile; nutlets obovoid, with truncate or rounded summit; fruiting heads 10 to 15 lines in diameter......................1. *S. eurycarpum.*

Inflorescence simple; pistillate flowers pediceled; nutlets spindle-shaped, with tapering summit; fruiting heads 7 to 10 lines in diameter.

Leaves (2½ to 5 lines wide) and bracts conspicuously scarious-margined.....2. *S. simplex.*

Leaves (1½ to 2 lines wide) and bracts not conspicuously scarious-margined.............. 3. *S. angustifolium.*

1. **S. eurycarpum** Engelm. Erect, rather slender, 3 to 8 feet high, with branching inflorescence; leaves flat and thin, slightly keeled beneath; staminate heads 5 to 13; pistillate heads 2 to 4 on the stem or branch, sessile or more commonly peduncled; fruiting heads ¾ to 1¼ inches in diameter; nutlets sessile, obovoid, several-angled, with a truncate or depressed summit, tipped with the short style, 3 (or nearly 3) lines broad, 4 lines long, including the style.

Los Angeles River, *Braunton* 571, to the San Joaquin Valley and north to British Columbia and east to the Atlantic coast.

Var. **greenei** Graebner. Branches of the inflorescence more erect; achenes rounded at summit.—Region of San Francisco Bay (Olema, Lake Merced) south to Lower California and north to British Columbia.

Refs.—SPARGANIUM EURYCARPUM Engelm. in Gray, Man. 5th ed. 481 (1867). Var. GREENEI Graebner in Engler, Pflzr. 4^{10}: 13 (1900). *S. greenei* Morong, Bull. Torr. Club, 15: 77 (1888), type loc. Olema, *Greene;* Jepson, Fl. W. Mid. Cal. 96 (1901). *S. californicum* Greene, Bull. Cal. Acad. 1: 11 (1884), based on material from Calistoga, Sacramento and West Oakland.

2. **S. simplex** Huds. Stems erect, 1 to 3 feet high, or sometimes floating; leaves 2 to 6 lines broad, slightly carinate; inflorescence usually simple; staminate heads 3 to 5, congested or confluent, but distant from the pistillate; pistillate heads 2 to 6, the lowest peduncled, some supra-axillary, 8 or 9 lines in diameter in fruit; nutlets narrow, 2 to 2½ lines long, 1 to 1½ lines thick on the lower third, at apex gradually attenuate into the long style, long-pediceled, often 2-celled.

Sierra Nevada: Kaweah Meadows; Silver Lake; Placer Co.; Donner Lake; Goose Lake, Shasta Co.; Modoc Co., *Mrs. M. H. Manning*. North to British Columbia and east to New England and Newfoundland.

Ref.—SPARGANIUM SIMPLEX Huds. Fl. Angl. 2d ed. 401 (1778).

3. **S. angustifolium** Michx. Stems 1 to 4 feet high; leaves exceedingly long and narrow, 1 to 2½ lines broad, floating or erect; inflorescence simple; staminate heads 2 to 6, sometimes blended but distant from the pistillate; pistillate heads sessile in the axils, often a little supra-axillary, rarely peduncled; nutlets 2½ lines long, brownish, constricted at or above the middle, abruptly contracted at apex into the long style or beak, pediceled.

Lakelets and slow streams: San Bernardino Mts. acc. Parish, north to British Columbia and east to Pennsylvania and Newfoundland.

Refs.—SPARGANIUM ANGUSTIFOLIUM Michx. Fl. Bor. Am. 2: 189 (1803); Graebner in Engler, Pflzr. 4^{10}: 16 (1900). *S. simplex* var. *angustifolium* Engelm. in Gray, Man. 5th ed. 481 (1867); Parish, Erythea, 6: 85 (1898).

NAIADACEAE. POND WEED FAMILY.

Water plants entirely submerged or with floating leaves. Leaves thread-like or grass-like or some with broad floating blades, commonly sheathing at base or with sheathing stipules. Flowers inconspicuous, naked or with a very small calyx, commonly borne on a short spike or spadix. Ovaries 1 to 4, distinct, free from the calyx if that be present, 1-celled, 1-ovuled, ripening into nutlet-like fruits.—Ten genera, the species of mostly wide distribution.

Bibliog.—Tuckerman, Edw., Potamogeton (Am. J. Sci. 2d ser. vol. 6, pp. 224-30,—1848; vol. 7, pp. 347-60,—1849). Morong, T., Naiadaceae of North America (Mem. Torr. Club, vol. 3, no. 2,—1893). Dudley, Genus Phyllospadix (Wilder Quarter-century Book, pp. 403-420, pls. 1-2,—1893). Fryer, A., Potamogetons of the British Isles (1898). Rendle, A. B., Naiadaceae (Engler, Pflzr. teil 4, abt. 12,—1901). Campbell, D. H., Morphological study of Naias and Zannichellia (Proc. Cal. Acad. 3rd ser. Bot. vol. 1, pp. 1-70, pls. 1-5,—1897). Ascherson & Graebner, Potamogetonaceae (Engler, Pflzr. teil 4, abt. 11,—1907).

Flowers perfect, in spikes or clusters.
  Calyx of 4 distinct sepals . . . . 1. POTAMOGETON.
  Calyx none. . . . . 2. RUPPIA.
Flowers unisexual; calyx none.
  Leaves entire.
    Pistils about 4, borne in a cup-shaped involucre; fresh water ponds or streams . . . . . .
      3. ZANNICHELLIA.

Pistils many, borne on the side of a linear spadix; maritime.

Flowers monoecious; nutlet ovoid; leaves 2 to 4 lines broad..............4. Zostera.

Flowers dioecious; nutlet sagittate-cordate; leaves ½ to 2 lines broad.............. 5. Phyllospadix.

Leaves with spiny-toothed margins; pistil solitary and naked...................6. Naias.

1. **POTAMOGETON** L. Pondweed.

Perennial herbs, commonly growing in the still waters of creeks and in fresh or brackish ponds, the stems arising from rootstocks. Leaves alternate, or the uppermost opposite, frequently of two kinds, the floating ones broad, the submerged narrower and often thread-like or linear; stipules present, often sheathing the stem. Flowers in spikes or heads on axillary peduncles and enclosed in the bud by stipular sheaths. Sepals 4, with short claws. Stamens 4, inserted on the base of sepals. Ovaries 4.—About 60 species, in all parts of the earth. (Greek potamos, a river, and geiton, a neighbor, on account of the aquatic habit.)

A. Stipules axillary and free from the leaf.

Plants with both submerged and floating leaves; petioles of floating leaves present, often long, short or none in no. 4.

Submerged leaves linear or thread-like, consisting of petioles only.

Floating leaves elliptical, subcordate at base..............................1. *P. natans.*

Floating leaves narrowly oblong, attenuate into the petiole.............2. *P. epihydrus.*

Submerged leaves linear or lanceolate, bearing true blades.

Flowers capitate; peduncles 1 to 3 lines long; floating leaves less than 1 inch long..... 3. *P. dimorphus.*

Flowers spicate; peduncles 2 inches long or more; floating leaves 2 to 4 inches long.

Plants reddish; nutlet with a distinct pit on each side..................4. *P. alpinus.*

Plants green; nutlet not pitted.

Nutlet distinctly 3-keeled; low altitudes........................5. *P. americanus.*

Nutlet indistinctly 3-keeled; high montane...................6. *P. heterophyllus.*

Submerged leaves, or some of them, broader and falcate.................7. *P. amplifolius.*

Plants with the leaves all submerged; petioles short or none.

Leaves with broad blades, ovate, orbicular or lanceolate, never linear.

Stipules greenish; leaves with a short petiole or subsessile................8. *P. lucens.*

Stipules white, with numerous fibrous nerves.

Leaves clasping, hooded at apex; peduncles often 8 inches long or more.............. 9. *P. praelongus.*

Leaves cordate-clasping, not hooded, the lobes at base often touching around the stem. 10. *P. perfoliatus.*

Leaves linear, thread-like, or setaceous.

Without propagating buds or glands...................................11. *P. foliosus.*

With both propagating buds and glands.

Leaves capillary; stem slender, not flattened.........................12. *P. pusillus.*

Leaves linear, 1 to 2 lines wide; stem much flattened..............13. *P. compressus.*

B. Stipules adnate to the leaf or petiole.

Plants with submerged leaves only.

Leaves capillary...14. *P. pectinatus.*

Leaves flat, ½ to 1½ lines broad.

Leaves in terminal clusters...15. *P. latifolius.*

Leaves 2-ranked..16. *P. robbinsii.*

1. **P. natans** L. Broad Pondweed. Stem thick, little if at all branched; floating leaves elliptical, subcordate at base, 1½ to 3 inches long, 1 to 2 inches broad, on petioles longer than the blade; stipules linear-lanceolate, membranaceous, 2 to 4 inches long; submerged leaves consisting of petioles without blades, 2 to 9 inches long or more and 1 line wide, usually perishing early, their tips sometimes reaching the surface of the water and forming miniature blades; spikes dense, 1 or 2 inches long, on longer peduncles; nutlet evidently keeled along the back, 2 lines long.

Montane region at 5000 to 7000 feet alt.: Bear Valley, San Bernardino Mts., *Parish;* Sierra Nevada; Mt. Shasta; northward to British Columbia and east to the Atlantic. Europe, Asia.

Refs.—POTAMOGETON NATANS L. Sp. Pl. 126 (1753); Wats. Bot. Cal. 2: 195 (1880); Morong, Mem. Torr. Club, 3^2: 13, pl. 25 (1893).

2. **P. epihydrus** Raf. Stems slender (½ line broad), compressed, mostly simple, 1 to 2 feet long; floating leaves narrowly oblong, 1¾ to 2 inches long, gradually narrowed into petioles about ½ as long; submerged leaves thin, grass-like, 2 to 3 inches long, 2 to 3 lines wide, the petiole-like base very short; spikes dense, ½ inch long, on peduncles 1¼ to 1½ inches long; nutlet flattish, 3-keeled, the seed impressed on the sides.

Yosemite Valley (*Bolander* 6393), north to British Columbia and east to the Atlantic States.

Refs.—POTAMOGETON EPIHYDRUS Raf. Med. Repos. 2d ser. 5: 354 (1808). *P. nuttallii* C. & S. Linnaea, 2: 226 (1827). *P. claytoni* Tuckerm. Am. Jour. Sci. 1st ser. 45: 38 (1843); Wats. Bot. Cal. 2: 195 (1880).

3. **P. dimorphus** Raf. Stems simple, 1½ feet long; floating leaves in 2 or 3 opposite pairs, oblong, tapering to each end, impressed beneath with 7 to 9 nerves, 3 to 4 lines wide and 7 to 10 lines long, passing rather definitely at base into the somewhat shorter (or sometimes longer) petiole; submerged leaves ¼ to ¾ line wide, 1 or 2 inches long, acute at tip but not setaceous, stipules 1 to 5 lines long, adnate for about ½ their length; flowers in a few-flowered head (or the emersed in a very short spike), the peduncles 1 to 3 lines long, shorter than the submersed spike; nutlet less than 1 line long, keeled on the back, the keel winged and sometimes denticulate; embryo coiled 1⅓ times; pericarp very thin and fleshless, revealing clearly the coiled embryo, the whole suggestive of a snail shell.

Lake Surprise, San Jacinto Mts., alt. 9000 feet, *Hall* 2490; near Visalia acc. Bot. Death Valley; irrigating ditches at Turlock. Missouri to Virginia and Nova Scotia.

Refs.—POTAMOGETON DIMORPHUS Raf. Am. Mo. Mag. 1: 358 (1817). *P. spirillus* Tuckerm. Am. Journ. Sci. 2d ser. 6: 228 (1848); Morong, Mem. Torr. Club, 3^2: 49, pl. 56 (1893).

P. HYBRIDUS Michx. Very similar to P. dimorphus but peduncles equaling or longer than submersed spike, frequently recurved; keels toothed.—Credited to California by Taylor (N. Am. Fl. 17^1: 17).

4. **P. alpinus** Balbis. ALPINE PONDWEED. Whole plant of a reddish tinge; stems simple, 1 or 2 feet long; floating leaves narrowly oblong, tapering at both ends, 2 to 4 inches long, ⅓ to ¾ inch wide, submerged leaves 2 to 7 inches long, ¼ to ½ inch wide, all sessile or narrowed to a short petiole; stipules broad, ½ to 1¼ inches long; spikes ⅜ to 1⅛ inches long, on peduncles about 2 inches long; nutlet with a distinct pit on each side.

Ponds in the high mountains: Sierra Nevada, North Fork of Kings River, 7000 feet alt., *Hall & Chandler;* Silver Valley, Alpine Co., 7200 feet alt., *Brewer* 1978; north to Alaska and east to Florida and Labrador. Europe, Asia.

Refs.—POTAMOGETON ALPINUS Balbis, Misc. 13 (1804); Morong, Mem. Torr. Club, 3^2: 19, pl. 30 (1893). *P. rufescens* Schrader; Chamisso, Adnot. Fl. Berol. 5 (1815); Wats. Bot. Cal. 2: 195 (1880).

5. **P. americanus** C. & S. Stems terete, much branched, 3 to 6 feet long; floating leaves coriaceous, elliptical, 2 to 4 inches long, ½ to 1½ inches wide, the petiole often longer than the blade, submerged leaves very thin, lanceolate,

4 to 12 inches long, 4 to 6 lines broad, rounded at base, or tapering into a petiole 1 to 4 inches long; stipules 1 to 4 inches long; peduncles 2 to 3 inches long; spikes 1 to 2 inches long, densely fruited; nutlet obliquely obovate, 1½ to 2 lines long, the back 3-keeled, with the middle keel prominent.

Ponds or slow creeks in the valleys or hills at low altitudes: Los Angeles Co.; Bakersfield and Visalia acc. Bot. Death Valley; Santa Cruz; Russian River; north to British Columbia and east to the Atlantic. Europe, Asia, north Africa.

Refs.—POTAMOGETON AMERICANUS C. & S. Linnaea, 2: 226 (1827); Jepson, Fl. W. Mid. Cal. 2d ed. 28 (1911). *P. lonchites* Tuckerm. Am. Jour. Sci. 2d ser. 6: 226 (1848); Morong, Mem. Torr. Club, 3^2: 20, pl. 31 (1893). *P. fluitans* of various California authors.

6. **P. heterophyllus** Schreb. Stems slender, compressed, branched, 1 to 2 feet long; floating leaves oval to oblong-elliptical, 1 or 2 inches long, 4 to 9 lines wide; petioles 1 to 4 inches long; stipules 1 inch long or less; submerged leaves linear-lanceolate, narrowed at base, sessile, 1 to 2 inches long, 1 to 3 lines wide; spikes 1 inch long; peduncles 1 to 4 inches long; nutlet roundish, ¾ to 1½ lines long, indistinctly 3-keeled.

Sierra Nevada at high altitudes: Volcano (formerly Whitney) Meadows, acc. Bot. Death Valley; near Mono Pass acc. Bot. Cal. North to Oregon and Washington and east to the Atlantic. Europe, Asia.

Refs.—POTAMOGETON HETEROPHYLLUS Schreb. Spicil. Fl. Lips. 21 (1771); Morong, Mem. Torr. Club, 3^2: 23 (1893). *P. gramineus* Wats. Bot. Cal. 2: 196 (1880), not L.

7. **P. amplifolius** Tuckerm. Stems mostly simple, 2 to 4 feet long; floating leaves oblong-ovate or oval, mucronate, ¾ to 1¼ inches broad, 2 to 3 inches long, the petioles of about the same length; submerged leaves with the sides folding together and assuming a falcate shape, the uppermost large, elliptical or ovate, 2½ to 4 inches long, the lower lanceolate and often as much as 8 inches long and 2 inches wide (acc. Morong); spikes ½ to 2 inches long; peduncles thickening upwards, 2 to 3 inches long; nutlet 3-keeled, the middle keel prominent.

Sierra Nevada from Red Lake on the San Joaquin River, *Congdon*, northward to Oregon and British Columbia and eastward to the Atlantic States.

Refs.—POTAMOGETON AMPLIFOLIUS Tuckerm. Am. Jour. Sci. 2d ser. 6: 225 (1848); Wats. Bot. Cal. 2: 196 (1880); Morong, Mem. Torr. Club, 3^2: 16, pl. 27 (1893).

P. ANGUSTIFOLIUS B. & P. Similar to P. lucens; upper leaves petioled, lower sessile, all lanceolate or oblanceolate, undulate, crisped, shining; submerged leaves serrulate at apex.—Credited to California by Taylor, N. Am. Fl. 17^1: 18.

8. **P. lucens** L. Stem thick, branching below and bearing masses of very leafy branches at summit; leaves all submerged, thin, elliptical to lanceolate or oblanceolate or the uppermost oval, acute or acuminate, often undulate-serrate, narrowed at base to a short petiole or sessile, 2 to 7 inches long and ¾ to 1¾ inches wide; stipules greenish, 1 to 2 inches long, loose and spreading, sometimes very broad; peduncles 3 to 6 inches long; spikes 2 to 2½ inches long, thick cylindrical; nutlet 1½ lines long, nearly as broad, with 3 distinct ribs on back.

Small lakes and ponds: Penasquitas Creek, San Diego Co., acc. Parish; San Francisco; north to British Columbia and east to Nova Scotia.

Refs.—POTAMOGETON LUCENS L. Sp. Pl. 126 (1753); Wats. Bot. Cal. 2: 196 (1880); Morong, Mem. Torr. Club, 3^2: 30, pl. 38 (1893); Parish, Erythea, 6: 85 (1898); Jepson, Fl. W. Mid. Cal. 100 (1901).

9. **P. praelongus** Wulf. Stems whitish, zigzag, 3 to 8 feet long, branching;

leaves all submerged, bright green, oblong-lanceolate, undulate, "cucullate at apex," sessile by a clasping base, 4 to 9 inches long, and ½ to 1 inch wide: stipules white, the uppermost obtuse, many-nerved, usually hugging the stem, ¾ to 1½ inches long; spikes 1 to 2 inches long, borne on peduncles 4 to 10 inches long (or even longer), erect and straight and often numerous; nutlet 2 to 2½ lines long.

Deep water of ponds: Sierra Co. (acc. Bot. Cal.); Oregon to British Columbia and east to New Jersey and Nova Scotia. Europe.

Refs.—POTAMOGETON PRAELONGUS Wulf. Roem. Arch. 3: 331 (1805); Wats. Bot. Cal. 2: 197 (1880); Morong, Mem. Torr. Club, 3^2: 32, pl. 39 (1893).

10. **P. perfoliatus** L. var. **richardsonii** Benn. Stems straight, simple or branching; leaves long-lanceolate and acute, wavy, cordate at base and clasping, 1 to 4 inches long; stipules ½ to ¾ inch long, many nerved, often becoming much frayed; spikes 8 to 11 lines long; peduncles 1¼ inches long; nutlet 1¾ lines long.

Sisson (Siskiyou Co.) acc. Crosfield; Oregon to British Columbia; east to New Jersey and Nova Scotia.

Refs.—POTAMOGETON PERFOLIATUS L. var. RICHARDSONII Benn. Jour. Bot. 27: 25 (1889); Morong, Mem. Torr. Club, 3^2: 33 (1893).

11 **P. foliosus** Raf. LEAFY PONDWEED. Stem flattened, much branched, 1 to 2½ feet high; leaves rather thickly clothing the stem, 1 to 1½ inches long, ½ to 1 line wide, abruptly acute; stipules white, transparent, 6 to 9 lines long; flowers few in a head on a peduncle 2 to 6 lines long; nutlet nearly 1 line long, 3-keeled on the back, the central keel with narrow rough-edged wing.

North Fork of Kern River acc. Bot. Death Valley; Gilroy; San Francisco; Birds Landing, *Jepson;* Mariposa, *Congdon;* Shasta Co., *Baker;* northward into Oregon and east to the Atlantic States. Var. CALIFORNICUS Morong. Bushy in its habit; stem thick.—Southern California from San Bernardino to San Diego; Oak Knoll, Los Angeles Co., acc. Davidson; eastern Oregon, acc Howell. Var. NIAGARENSIS Gray. Large-sized; leaves often 3 inches long or more; stipules longer than in the type.—Visalia, acc. Bot. Death Valley. Ontario to New England and south.

Refs.—POTAMOGETON FOLIOSUS Raf. Med. Repos. 2d hex. 5: 354 (1808); Morong, Mem. Torr. Club, 3^2: 39, pl. 47 (1893); Jepson, Fl. W. Mid. Cal. 2d ed. 28 (1911). Var. CALIFORNICUS Morong, Bot. Gaz. 10: 254 (1885), type from San Diego, *Cleveland;* Howell, Fl. Nw. Am. 676 (1903). Var. NIAGARENSIS Gray, Man. 2d ed. 435 (1856). *P. pauciflorus* Pursh, Fl. Am. Sept. 121 (1814); Wats. Bot. Cal. 2: 197 (1880); Jepson, Fl. W. Mid. Cal. 100 (1901). *P. niagarensis* Tuckerm. Am. Jour. Sci. 2d ser. 7: 354 (1849); Wats. Bot. Cal. 2: 197 (1880).

12. **P. pusillus** L. SLENDER PONDWEED. Stems filiform, branching, ½ to 1 foot long; leaves narrowly linear, acute, with a crater-like gland on each side of the stem at base of the petiole or rarely glandless, 1 to 3 inches long, ¼ to ¾ line wide, sessile; stipules short, obtuse, becoming setose; peduncles flattened, slender, ½ to 3 inches long; spikes interrupted or capitate; nutlet obliquely elliptical, ¾ to 1 line long, with a groove on each side of the rounded back, or sometimes with 3 distinct keels, beaked by a short style.

Santa Cruz; Palo Alto; San Francisco; Sierra Nevada; Sisson; Oregon to British Columbia and east to the Atlantic States, south into Mexico. Europe, Asia. Var. TENUISSIMUS Mert. & Koch. Leaves setaceous.—Soda Springs, Tuolumne Meadows, acc. Bot. Cal.

Refs.—POTAMOGETON PUSILLUS L. Sp. Pl. 127 (1753); Wats. Bot. Cal. 2: 198 (1880); Morong, Mem. Torr. Club, 3^2: 45, pl. 53 (1893); Jepson, Fl. W. Mid. Cal. 100 (1901). Var. TENUISSIMUS Mert. & Koch, Deutschl. Fl. 1: 857 (1823).

13. **P. compressus** L. EEL-GRASS PONDWEED. Stem very much flattened; foliage bright green and shining; leaves fascicled at summit of the branches, with numerous fine nerves, 2 to 6 inches long, 1¼ to 2 lines wide, abruptly acute, mucronate, sessile; stipules scarious, soon perishing; spikes ½ to 1 inch long, on peduncles 1 to 4 inches long; nutlet nearly or quite 2 lines long, 3-keeled on back.

Honey Lake Valley, Lassen Co., *Davy* 3356; Oregon to British Columbia and east to New Jersey and New Brunswick. Europe.

Refs.—POTAMOGETON COMPRESSUS L. Sp. Pl. 127 (1753); Hegi, Ill. Fl. Mittel-Europa, 1: 132, fig. 60 (1906). *P. zosteraefolius* Schum. Enum. Pl. Saell. 1: 50 (1801); Morong, Mem. Torr. Club, 3^2: 37, pl. 45 (1893).

14. **P. pectinatus** L. FENNEL PONDWEED. Stems ½ or 2 to 6 or 8 feet long, from a running rootstock, repeatedly forking above, then very leafy and forming broom-like clusters; leaves very slender, setaceous, 1 to 3 inches long exclusive of the sheaths which are ½ to ¾ inch long or on the lower leaves even 2 inches long; scarious margin of the sheaths very narrow; spikes ½ to 1½ inches long, the flowers in distinctly separated whorls; peduncles 1 to 3 or more inches long; nutlet 1½ to 2 lines long, with an obscure ridge on each side of the back.

The most common species throughout the state from sea-level to 7000 feet altitude. Beyond our borders of world-wide distribution. The rootstocks imbedded in the mud of ponds bear tubers about the size of a pea. The deep-diving ducks, such as the Canvas-back and Broad-bill, feed upon these sweet nutritious tubers, pulling loose at the same time more or less of the tender rootstocks and the attached stems which float to the surface and are shared with the surface-feeding species like the Teal and Mallard. It is to this plant that the Canvas-back, while living in the salt-marshes, owes the succulent and nutty flavor of its flesh, making it in the eyes of sportsman and epicure superior to every other kind of Californian wild-fowl.

Refs.—POTAMOGETON PECTINATUS L. Sp. Pl. 127 (1753); Wats. Bot. Cal. 2: 198 (1880); Morong, Mem. Torr. Club, 3^2: 51, pl. 58 (1893); Hegi, Ill. Fl. Mittel-Europa, 1: 137, fig. 67 (1906); Jepson, Fl. W. Mid. Cal. 2d ed. 29 (1911).

15. **P. latifolius** Morong. Near the preceding; stems stoutish, white, branching; leaves numerous, fascicled terminally, ½ to 1½ lines broad; adnate portion of stipule ¼ to 1 inch long, broad on the uppermost leaves, scarious-margined, the free portion shorter.

Brackish water: Honey Lake Valley, Lassen Co., *Davy* 3357; Goose Lake, *Mrs. R. M. Austin*, acc. Morong; also apparently at Gilroy. Northwestern Nevada.

Refs.—POTAMOGETON LATIFOLIUS Morong, Mem. Torr. Club, 3^2: 52, pl. 59 (1893); Jepson, Fl. W. Mid. Cal. 2d ed. 29 (1911). *P. pectinatus* var. (?) *latifolius* Robbins, U. S. Expl. 40th Par. 5: 338 (1871), type loc. Humboldt River below Humboldt Lake, Nev.; Wats. Bot. Cal. 2: 198 (1880).

16. **P. robbinsii** Oakes. Stems stout; rootstocks running, sometimes nearly 1 foot long; leaves crowded in 2 ranks, 1½ to 4 inches long, 1½ to 2 lines wide, obtuse, mucronate, auriculate at junction of free portion of stipule; adnate portion of stipules about ½ inch long, the free portion as long or longer.

Honey Lake Valley, Lassen Co., *Davy*. Oregon to British Columbia, east to Delaware and New Brunswick.

Refs.—POTAMOGETON ROBBINSII Oakes, in Hovey, Mag. Hort. 7: 180 (1841); Morong, Mem. Torr. Club, 3^2: 54, pl. 61 (1893).

2. RUPPIA L.

Immersed aquatic herbs with long filiform forking stems. Leaves almost capillary, with a broad membranous sheathing base. Peduncles slender, axillary, at first very short and enclosed in the spathe-like base of the leaf, each bearing two flowers disposed near together and rising to the surface in the period of anthesis, afterwards coiling and drawing the fruits beneath the surface. Flowers perfect, entirely destitute of perianth. Stamens 2, sessile, each anther consisting of 2 large and separate anther-cells. Pistils 4, after flowering becoming stalked and ripening into hard ovoid nutlets; stigmas depressed, sessile.—One species. (H. B. Ruppius, a German botanist of the 18th century.)

1. **R. maritima** L. Ditch-grass. Plants 2 to 3 feet long; leaves 2 to 3 inches long; nutlets $\frac{3}{4}$ to $1\frac{1}{4}$ lines long, raised on stipes 1 to 12 lines long; fruiting peduncle 3 to 6 lines long.

Alkaline or brackish waters: southern California northward through the state. Cosmopolitan.

Refs.—Ruppia maritima L. Sp. Pl. 127 (1753); Wats. Bot. Cal. 2: 194 (1880); Jepson, Fl. W. Mid. Cal. 101 (1901).

3. ZANNICHELLIA Mich.

Immersed aquatic plants, flowering and fruiting under water, the thread-like stems from a creeping rootstock. Leaves opposite or in whorls. Flowers monoecious, without perianth, sessile, both kinds in the same axil: staminate flowers consisting of an anther on a pedicel-like filament; pistillate flowers 2 to 6 (usually 4) in a cluster and surrounded by a hyaline cup-shaped involucre shorter than the pistils, each flower consisting of a single pistil with a thin peltate stigma on the summit of the short style. Fruit an oblong somewhat flattened, beaked nutlet.—One species. (G. G. Zannichelli, 1662—1729, a botanist of Venice.)

1. **Z. palustris** L. Horned Pondweed. Stems sparingly branched, 1 to $1\frac{1}{2}$ feet long; leaves 1 to 2 inches long, filiform but flat; nutlet slightly incurved, becoming stipitate, 1 to $1\frac{1}{2}$ lines long, often roughened or toothed on the back.

Pools and still waters of streams: Los Angeles, Santa Barbara and northward to San Leandro Creek, *N. L. Gardner*, and the Sacramento Valley. Nearly throughout North America. Cosmopolitan.

Refs.—Zannichellia palustris L. Sp. Pl. 969 (1753); Wats. Bot. Cal. 2: 193 (1880); Morong, Mem. Torr. Club, 3^2: 57, pl. 64 (1893); Jepson, Fl. W. Mid. Cal. 101 (1901).

4. ZOSTERA L. Grass-wrack.

Submerged maritime herbs with elongated and very narrow grass-like radical leaves and inflorescences raised on peduncle-like stems. Flowers monoecious, borne in 2 rows on the face of a flattened spadix with or without small lateral appendages covering them in the bud and closely invested by a protecting leaf-like spathe until anthesis. Staminate flower of 1 stamen. Pistillate flower of 1 pistil. Nutlet ovoid.—North and south temperate zones, 5 species. (Greek zoster, a girdle or band, on account of the ribbon-like leaves.)

1. **Z. marina** L. Eel-grass. Leaves with long sheathing bases, 3 to 7-nerved, 1 to 4 feet long, 1 to 4 lines broad; spathes jointed at base, ending above in a more or less elongated leaf-like summit; spadix 2 to 4 inches long, 10 to 20-fruited; fruits $1\frac{1}{2}$ lines long, the ribs of the seed showing clearly on the pericarp.

Shoal waters of bays, San Pedro to San Francisco Bay and north to Alaska.

Var. LATIFOLIA Morong. Stem stout, sometimes 8 or 10 feet long; leaves 3 to 6 lines wide; nutlet with a distinct stipe, the pericarp splitting along the face; seed without ribs.—Santa Barbara (type loc.) to Monterey, Bolinas Bay and northward to Puget Sound.

Refs.—ZOSTERA MARINA L. Sp. Pl. 968 (1753); Wats. Bot. Cal. 2: 192 (1880); Morong, Mem. Torr. Club, 3^2: 62, pl. 69 (1893); Jepson, Fl. W. Mid. Cal. 101 (1901). *Z. pacifica* and *oregana* Wats. Proc. Am. Acad. 26: 131 (1891). Var. LATIFOLIA Morong, Bull. Torr. Club, 13: 160 (1886). *Z. latifolia* Morong, Mem. Torr. Club, 3^2: 63, pl. 71 (1893).

5. PHYLLOSPADIX Hook.

Aquatic plants of rocky ocean shores, closely related to Zostera, with elongated narrowly-linear radical leaves from much branched creeping rootstocks. Flowers dioecious, borne in 2 rows on the side of a flattened spadix, with a lateral chartaceous appendage covering each flower in the bud, the whole inflorescence enclosed by a spathe which is produced beyond the spadix as a foliaceous prolongation. Staminate spadices with sessile anthers; pistils or rudiments none. Pistillate spadices with rudimentary anthers alternating with the pistils; pistils simple, with 2 stigmas; ovary sagittate-cordate, i. e., with two downwardly-produced horns at base, which in fruit are strongly developed and bear on the inside deflexed bristles serving to attach the floating nutlets to other plants on the beaches.—Two or 3 species. (Greek phullon, leaf, and spadix, a kind of inflorescence.)

Flowering stems 1 foot long or more, bearing 2 to 5 pistillate spadices..........1. *P. torreyi.*
Flowering stems 2 or 3 inches long, bearing 1 pistillate spadix or rarely 2......2. *P. scouleri.*

1. **P. torreyi** Wats. Rootstocks brittle; leaves 1½ to 2 feet long, ½ to 1 line broad; pistillate spadices 1 to 1¾ inches long; staminate spadices shorter and with shorter peduncles; nutlet 2½ lines long.

Low tide limits to two fathoms below: San Diego south to Ensenada (Lower California), north to Santa Barbara, Bolinas Bay and Russian River; usually in more quiet waters than the next. The plants have been used for fireproofing and deadening as a filling between the walls of buildings.

Refs.—PHYLLOSPADIX TORREYI Wats. Proc. Am. Acad. 14: 303 (1879), type loc. Santa Barbara, *Torrey;* Wats. Bot. Cal. 2: 192 (1880); Morong, Mem. Torr. Club, 3^2: 64, pls. 72, 74 (1893); Jepson, Fl. W. Mid. Cal. 102 (1901); Abrams, Fl. Los Ang. 14 (1904).

2. **P. scouleri** Hook. Very similar to the preceding but the leaves rather broader, ¾ to 2 lines wide, and more obviously 3-nerved; nutlet larger.

Santa Barbara, Pacific Grove, Dillon's Beach (*Baker*), Russian River (*Dudley*) and northward to the Columbia River and Vancouver Island. Also on the coast of Hokaido (Japan).

Refs.—PHYLLOSPADIX SCOULERI Hook. Fl. Bor. Am. 2: 171, t. 186 (1839); Wats. Bot. Cal. 2: 192 (1880); Morong, Mem. Torr. Club, 3^2: 65, pls. 73, 74 (1893); Jepson, Fl. W. Mid. Cal. 102 (1901).

6. NAIAS L. NAIAD.

Slender branching submerged fresh-water plants with linear opposite spiny-toothed leaves, which are seemingly whorled on account of the ones crowded in the axils. Flowers monoecious or dioecious, solitary in the axils. Staminate flower consisting of a single stamen enclosed by two perianth-like envelopes. Pistillate flower naked, consisting of a single ovary bearing a style with 2 to 4 stigmas. Fruit a seed-like nutlet, tipped with the persistent style.—World-wide distribution, 32 species. (Greek Naias, a water-nymph.)

Leaves coarsely toothed, the sheathing base entire or with 1 or 2 teeth on each side; stems and back of the leaves often spiny; flowers dioecious........................1. *N. marina.*

Leaves very minutely serrulate; flowers monoecious; stems unarmed.
  Nutlet shining, smooth; sheathing base of leaves with many minute teeth on its upper portion. . . . . .2. *N. flexilis.*
  Nutlet dull, reticulated; sheathing base of leaves commonly narrow and with few teeth or sometimes entire. . . . . .3. *N. guadalupensis.*

1. **N. marina** L. Holly-leaved Naiad. Stems stout, often armed with prickles twice as long as their breadth; leaves linear, ¾ to 1½ inches long, 1 to 1½ lines broad, coarsely saw-toothed, with the teeth spinulose-tipped and the broad sheathing base entire or with 1 or 2 teeth on each side; nutlet 2 to 2½ lines long, reticulated.

Clear Lake to Lower California, east to the Atlantic States. Rare in North America. Europe, Asia, Australia. Var. californica Rendle. Internodes sparingly spinose; leaves very coarsely toothed and with 4 to 6 dorsal spines.—Described from specimens collected by Coulter and Orcutt, therefore evidently southern California.

Refs.—Naias marina L. Sp. Pl. 1015 (1753); Morong, Mem. Torr. Club, 3^2: 58, pl. 65 (1893); Jepson, Fl. W. Mid. Cal. 102 (1901). Var. californica Rendle, Trans. Linn. 2d ser. 5: 398, t. 39, fig. 15 (1899). *N. major* Allioni, Fl. Pedem. 2: 221 (1785); Wats. Bot. Cal. 2: 191 (1880).

2. **N flexilis** R. & S. Slender Naiad. Stems slender; leaves narrowly linear, very minutely toothed, mostly acuminate, ½ to 1 inch long, ¼ to ½ line wide; nutlet oblong-ovoid, 1 to 2 lines long, nearly smooth, shining.

Southern California (Soldiers' Home, acc. Davidson) to San Francisco, north to Washington and east to the Atlantic. Europe.

Refs.—Naias flexilis R. & S. Fl. Sedin. 382 (1824); Wats. Bot. Cal. 2: 191 (1880); Morong, Mem. Torr. Club, 3^2: 59, pl. 66 (1893); Jepson, Fl. W. Mid. Cal. 102 (1901).

3. **N. guadalupensis** Morong. Stems thread-like, 1 to 2 feet long; leaves 6 to 9 lines long, ½ line wide or something less, abruptly acute; nutlet cylindrical, 1 to 1½ lines long, dull but distinctly marked with numerous rows of squarish reticulations.

Oregon to San Francisco and southeastward to the Atlantic. Tropical America.

Refs.—Naias guadalupensis Morong, Mem. Torr. Club, 3^2: 60, pl. 67 (1893). *Caulinia guadalupensis* Spreng. Syst. 1: 20 (1825), type loc. Guadalupe Island.

JUNCAGINACEAE. Arrow-grass Family.

Marsh or sub-aquatic herbs with basal rush-like or grass-like leaves, and small flowers in racemes or spikes, or solitary. Perianth regular, 3 or (in ours) 6-parted, the 3 outer segments (sepals) resembling the 3 inner (petals), or perianth none. Stamens in ours 6 or 1. Ovaries 1, or 3 to 6 and united. Embryo straight.—Temperate zones, 5 genera.

Bibliog.—Buchenau, Fr., Scheuchzeriaceae (Engler, Pflzr. teil 4, abt. 14,—1903). Campbell, D. H., Development of the Flower and Embryo in Lilaea subulata (Ann. Bot. vol. 12, pp. 1-28, pls. 1-3,—1898).

Flowers perfect, in a raceme; perianth 6-parted; stamens 6.
  Leaves all basal; flowers greenish, numerous in bractless spike-like racemes. .1. Triglochin.
  Leaves both basal and cauline; flowers white, few in a loose bracted raceme. . . . . 2. Scheuchzeria.
Flowers polygamous, in a spike, also with some solitary; perianth none; stamen 1. .3. Lilaea.

1. TRIGLOCHIN L.

Perennial by means of short rootstocks. Leaves fleshy with membranous sheaths. Flowers small, in a spike-like bractless raceme raised on a scape. Perianth 6-parted, deciduous, the three inner segments inserted higher. Stamens in ours 6; anthers sessile or nearly so. Pistils in ours commonly 6 (rarely

3 to 5), their ovaries united around a central axis, splitting when ripe into 1-seeded carpels, which separate from the base upward, and leave a slender persistent axis. Stigmas as many as the ovaries, plumose. Carpels dehiscing by the ventral suture.—World-wide distribution, 12 species. (Greek tri, three, and glochis, a point, referring to the fruit of the 3-carpeled species.)

1. **T. maritima** L. COMMON ARROW-GRASS. Terminal portion of the rootstock covered with the sheaths of old leaves; scapes stout, 1 to 1½ feet long, bearing a raceme 10 to 15 inches long, the whole surpassing the (2 to 3 lines wide) leaves; flowers 1 line long, longer than the pedicels, these in fruit conspicuously decurrent; carpels 3-angled, with the dorsal angles winged, making a broad longitudinally-striate groove on the back, 2½ lines long, the stigmas persistent and recurved.

Marshy shores along the coast and saline places in the interior: San Diego and Los Angeles Co., to San Francisco Bay, Great Valley and Sierra Nevada, north to Alaska, east to New Jersey and Labrador. Europe, Asia.

Var. **debilis** Jones. SLENDER ARROW-GRASS. Scapes very slender and racemes looser than in the preceding, 7 to 13 inches high; leaves usually less than 1 line wide; flowers about ½ line long; carpels rather less than 2 lines long; fruiting pedicels less obviously decurrent.—Salt marshes, San Francisco Bay; south to Antelope Valley and San Diego, north to Honey Lake Valley, *Davy*, and east to Nevada and Utah.

Refs.—TRIGLOCHIN MARITIMA L. Sp. Pl. 339 (1753); Wats. Bot. Cal. 2: 199 (1880). Var. DEBILIS Jones, Proc. Cal. Acad. 2d ser. 5: 722 (1895), type loc. alkaline flats at Johnson, Utah, *Jones*. *T. concinna* Davy, Erythea, 3: 117 (1895); 6: 4, 7 (1898); type loc. Newark, *Davy*, no. 1116; Jepson, Fl. W. Mid. Cal. 103 (1901).

2. SCHEUCHZERIA L.

Rush-like perennials with creeping rootstocks, erect leafy zig-zag stems, and small flowers in a loose terminal raceme. Leaves grass-like, flat above, semiterete below, tubular at apex, sheathing the stem at base, reduced to bracts above. Flowers white, few in a lax raceme. Perianth 6-parted, persistent, its segments nearly alike, the inner narrower. Stamens 6, inserted on the base of the perianth-segments. Ovaries 3, nearly distinct, 1 to 3-ovuled, bearing flat sessile stigmas, becoming in fruit divergent inflated coriaceous follicles dehiscent along the inside.—North temperate zone, 1 species. (The brothers J. and J. J. Scheuchzer, Swiss botanists, early in 18th century.)

1. **S. palustris** L. Stems solitary or several, 4 to 10 inches high; leaves 4 to 12 inches long; pedicels 3 to 10 lines long, spreading in fruit; perianth-segments membranous, 1-nerved, 1½ lines long; follicles 2 to 4 lines long.

Bogs: Sierra Co. (acc. Bot. Cal.) to Oregon and Alaska, east to Pennsylvania and Labrador. Europe, Asia.

Refs.—SCHEUCHZERIA PALUSTRIS L. Sp. Pl. 338 (1753); Wats. Bot. Cal. 2: 199 (1880); Morong, Mem. Torr. Club, 3^2: 9, pl. 23 (1893); Howell, Fl. Nw. Am. 677 (1903).

3. LILAEA H. & B.

Sub-aquatic annual with fibrous roots and basal cylindrical or rush-like leaves sheathing at base. Flowers in spikes raised on scapes and also with solitary pistillate flowers in the axils of the basal leaves. Spikes unisexual or with perfect flowers in the middle, pistillate below and staminate above, all in the axils of bracts except the pistillate. Staminate flowers consisting of a single stamen. Perfect flowers made up of a stamen and a pistil. Pistillate flowers consisting of a single pistil with short style, those in the axils of the basal leaves with extraordinarily long styles. Fruits coriaceous, flattish, oblong-ovate, winged, longitudinally ribbed, 1-seeded, indehiscent, those in the axils of the basal leaves less compressed and wingless.—One species. (A. R. Delile, French botanist, 1778—1850, author of a Flora of Egypt.)

1. **L. subulata** H. & B. Leaves 6 to 8 inches long, 1 to 2 lines in diameter, tapering to a point; spikes dense, ½ inch long or less; basal pistillate flowers often with a style 1 to 3 inches long, their fruits larger than those of the spike, 2½ to 3 lines long.

In water or mud of shallow vernal pools in the valleys or foothills: British Columbia to middle California (where it is common), south to southern California and Mexico. South America.

Refs.—LILAEA SUBULATA H. & B. Pl. Aequin. 1: 222, t. 63 (1808); Wats. Bot. Cal. 2: 193 (1880); Engler & Prantl, Nat. Pflzfam. 2^1: 225, fig. 172 (1889); Morong, Mem. Torr. Club, 3^2: 10, pl. 24 (1893); Jepson, Fl. W. Mid. Cal. 104 (1901).

ALISMACEAE. WATER PLANTAIN FAMILY.

Marsh or aquatic herbs with basal leaves, scape-like flower stems and perfect or unisexual flowers. Perianth of 3 outer herbaceous persistent sepals and 3 inner white delicate deciduous petals. Stamens 6 to many or numerous. Ovaries numerous, distinct, 1-celled, 1-ovuled, becoming achenes in fruit. Endosperm none; embryo strongly recurved or folded.—Ten genera, temperate and tropic zones.

Bibliog.—Buchenau, Alismataceae (Engler, Pflzr. teil 4, abt. 15, 1903). Smith, J. G., Revision of the North American Species of Sagittaria and Lophotocarpus (Rep. Mo. Bot. Gard. vol. 6, pp. 27-64, pls. 1-29,—1895); Revision of the Species of Lophotocarpus of the U. S. (l. c. vol. 11, pp. 145-151, pls. 53-58,—1899).

Achenes verticillate in a single whorl; stamens 6.
  Petals entire; style lateral; achenes minutely beaked........................1. ALISMA.
  Petals incised; style apical; achenes long-beaked........................2. DAMASONIUM.
Achenes numerous, crowded on a globose or elevated receptacle; stamens 9 to many.
  Leaves entire; achenes turgid; flowers all perfect........................3. ECHINODORUS.
  Leaves typically sagittate; achenes strongly flattened; flowers not all perfect.
    Flowers polygamous, the lower perfect, the upper staminate..........4. LOPHOTOCARPUS.
    Flowers unisexual, the lower pistillate, the upper staminate..............5. SAGITTARIA.

1. **ALISMA** L.

Erect perennial herbs of shallow water or mud. Inflorescence a panicle of whorled branches each bearing a simple or compound umbel of perfect flowers. Petals small, scarcely exceeding the sepals. Stamens 6, with short filaments. Ovaries distinct, on a disk-like receptacle. Achenes numerous, channeled on the back, crowded in a whorl.—One polymorphic species, with several strongly marked subspecies. (Alisma, the Greek name.)

1. **A. plantago** L. WATER PLANTAIN. Plants 2 to 4 (or 6) feet high; rootstock becoming almost bulbous by the sheathing bases of the petioles; leaf-blades ovate to oblong, abruptly acute, the larger often subcordate at base, 2 to 6 (or 9) inches long, usually on long petioles; whorled branches of flowering stems unequal in length, forming a loose pyramidal panicle; pedicels 1 inch long or less; petals white, 1 line long; achenes very strongly flattened, oblong, 1 line long.

Common along the margins of ponds, rivers, and marshy shores of lakes: Coast Ranges; Great Valley; Sierra Nevada to 5000 feet. Widely distributed, as a polymorphic species, through the north temperate zone and in north Africa and Australia.

Refs.—ALISMA PLANTAGO L. Sp. Pl. 342 (1753); Wats. Bot. Cal. 2: 200 (1880); Jepson, Fl. W. Mid. Cal. 104 (1901). A. brevipes Greene, Pitt. 4: 158 (1900); commonly larger, flower parts larger; petals 2 to 3 lines long, much longer than the sepals.—Type loc. Colorado, credited to California in N. Am. Fl. 17^1: 44.

2. **DAMASONIUM** Juss.

Annual or perennial herbs. Flowers perfect. Petals delicate, spreading, incised, soon marcescent. Stamens 6, in pairs opposite each sepal. Ovaries 6 to 10, 1 to several-ovuled, attached by their short ventral side to the conical receptacle. Achenes with long erect beak, radiately whorled and divergent.—Species 4, 3 in Europe, Asia, Africa and Australia, and 1 in California. (Name of uncertain origin.)

1. **D. californicum** Torr. Stems erect, slender, 8 to 16 inches high, arising from tuberous perennial rootstocks; leaf-blades ovate to lanceolate, 3 to 5-nerved, 1 to $1\frac{1}{2}$ inches long, long-petioled; panicle simple, with 2 to 4 verticils of 3 to 10 flowers; petals almost orbicular, 4 to 5 lines long, larger than the sepals; ovaries 1-ovuled; achenes ribbed on back, with long subulate beak.

Pools and shallow shores: Petaluma, *Congdon;* Sacramento Valley (College City, *Emma Wilkins*, Sutter Co., *Copeland*); northern Sierra Nevada from Ione Valley, 500 feet alt., *Bigelow*, to Sierra Valley, *Lemmon*, Big Meadows, Plumas Co., *Mrs. R. M. Austin*, Honey Lake Valley, alt. 4000 feet, *Davy*, and north to Egg Lake, Modoc Co., *Baker*.

Refs.—DAMASONIUM CALIFORNICUM Torr. in Benth. Pl. Hartw. 341 (1857), type from Sacramento Valley (neighborhood of Chico), *Hartweg;* Torr. Pac. R. R. Sur. 4: 142, pl. 21 (1857); Wats. Bot. Cal. 2: 200 (1880). *Alisma californica* Mich. in DC. Monogr. Phan. 3: 34 (1881). *Machaerocarpus californicus* Small. N. Am. Fl. 17^1: 44 (1909).

3. **ECHINODORUS** Rich.

Annual or perennial herbs with the habit of Sagittaria. Stem scapose, with the perfect flowers on short pedicels in umbel-like whorls. Stamens 6 to 12 or more. Ovaries 1-ovuled, many to numerous, crowded on a globose receptacle, attenuate into the terminal style. Achenes sharply ribbed.—Species 18 or 20, North and South America, Europe, Africa. (Greek echinos, hedgehog, and doros, utricle, or leather bottle, in reference to the prickly fruit.)

1. **E. cordifolius** Griseb. Annual; leaf-blades ovate, 5 to 9-nerved, obtuse, truncate or cordate at base, $1\frac{1}{2}$ to 6 (or 8) inches long, long-petioled; scapes erect, $1\frac{1}{4}$ to 2 feet high; umbels distant, 3 to 12-flowered, proliferous and forming a sparingly branched panicle; corolla 4 to 5 lines broad; stamens 12; fruiting heads globose-ovate, 3 lines long; achenes 1 line long, strongly several-ribbed, with a conspicuous erect straight beak.

Borders of pools and streams, southern California: Garvanza, *Davidson;* Ramona; Elsinore Lake, *Parish;* Lakeside, *Hall.* Eastward to Florida and Illinois and south into Mexico and Lower California. Also lower San Joaquin River, *K. Brandegee*, Sept., 1907.

Refs.—ECHINODORUS CORDIFOLIUS Griseb. Abh. K. Ges. Wiss. Gött. 7: 257 (1857). *Alisma cordifolium* L. Sp. Pl. 343 (1753). *Echinodorus rostratus* Engelm. in Gray, Man. 460 (1848); Wats. Bot. Cal. 2: 201 (1880).

4. **LOPHOTOCARPUS** T. Durand.

Closely allied to Sagittaria. Leaves sagittate, sometimes with entire blades or reduced to phyllodes. Flowers polygamous (perfect and staminate). Sepals accrescent, erect and appressed in fruit. Stamens 9 to 21. Fruiting pedicels recurved.—Species 5 or 6, North and South America, Java, Madagascar. (Greek lophos, crest, and karpos, fruit.)

1. **L. calycinus** J. G. Sm. Aquatic; leaves submerged, floating or erect; scapes simple, bearing 3 to 5 whorls of flowers.

Stockton; Los Angeles Co.; east to the Atlantic.

Refs.—LOPHOTOCARPUS CALYCINUS J. G. Sm. Rep. Mo. Bot. Gard. 11: 147 (1899). *Sagittaria calycina* Engelm. in Torr. Bot. Mex. Bound. 212 (1859). *Lophotocarpus californicus* J. G. Sm. Rep. Mo. Bot. Gard. 11: 146, pl. 54 (1899), type from Coyote Creek, Los Angeles Co., *Parish Bros.* 1136. *L. fluitans* J. G. Sm. Rep. Mo. Bot. Gard. 11: 145, pl. 53 (1899).

5. SAGITTARIA L. ARROW-HEAD.

Marsh or aquatic perennial herbs with thickened or tuberous rootstocks, fibrous roots and milky juice. Leaves sheathing the stem at base; earlier leaves (phyllodia) destitute of blades, later producing small entire blades or most commonly sagittate blades. Flowers pediceled, borne in whorls of 3 on the upper part of the stem, with membranous bracts. Flowers monoecious (rarely dioecious), the staminate above. Petals longer than the sepals. Stamens numerous, inserted above the receptacle. Ovaries indefinitely numerous, crowded on a globose receptacle. Achenes flat, winged or margined, beaked by the short style.—Species about 25, mostly North and South America, a few in Europe and Asia. (Latin sagitta, an arrow, referring to the shape of the leaves.)

Sepals of pistillate flowers reflexed or spreading, not accrescent.
Pedicels of pistillate flowers slender, ascending; leaves (or some of them) with sagittate lobes.
Basal lobes equaling or shorter than the terminal one; achenes without wings or crests on sides.
Achenes with prominent horizontally oblique beak......................1. *S. latifolia.*
Achenes with minute erect beak.......................................2. *S. arifolia.*
Basal lobes longer than terminal one; achenes almost beakless, the sides with a prominent wing-margined depression................................3. *S. greggii.*
Pedicels of pistillate flowers much thickened, reflexed in fruit; leaves not sagittate...... 4. *S. sanfordii.*
Sepals of the pistillate flowers erect and accrescent......................5. *S. montevidensis.*

1. **S. latifolia** Willd. TULE POTATO. Leaf-blades sagittate, very variable in outline and size, 2 to 12 inches long; basal lobes lanceolate to broadly ovate, acuminate, commonly divaricate, ½ to as long as the terminal lobe; scape simple or branched, ¼ to 3 feet high; flowers monoecious or dioecious; stamens 20 to 25; achene 1½ lines long, with somewhat swollen dorsal wing and long horizontally oblique beak.

Rivers and deltas of the Sacramento and San Joaquin valleys, especially abundant on the river islands; swamps and meadows in the Sierra Nevada to 6000 feet. Los Angeles north to British Columbia. Almost throughout North America. The edible tubers are used by the Chinese of the lower Sacramento.

Refs.—SAGITTARIA LATIFOLIA Willd. Sp. Pl. 4: 409 (1806); Jepson, Fl. W. Mid. Cal. 105 (1901); Abrams, Fl. Los Ang. 18 (1904). *S. variabilis* Engelm. in Gray, Man. 461 (1848); Wats. Bot. Cal. 2: 201 (1880).

2. **S. arifolia** Nutt. Very near the preceding; leaf-blades sagittate, 2½ to 7 inches long; terminal lobe ovate to lanceolate or nearly linear; basal lobes narrower than the terminal; scapes as long as the leaves or commonly shorter; flowers monoecious; achenes obovate, 1 to 1½ lines long, winged all around, bearing a minute erect beak.

San Bernardino Mts. through the Sierra Nevada to Lassen Co., north to British Columbia and east to New Mexico and Nova Scotia.

Refs.—SAGITTARIA ARIFOLIA Nutt.; J. G. Sm., Rep. Mo. Bot. Gard. 6: 32, pl. 1 (1894). *S. cuneata* Sheldon, Bull. Torr. Club, 20: 283, pl. 159 (1893).

3. **S greggii** J. G. Sm. Plants 2 to 4 feet high; leaf-blades 8 to 16 inches long, on long petioles; basal lobes lanceolate, acuminate, widely divergent, longer than the lanceolate or ovate, acuminate terminal one; submersed leaves

with an entire lanceolate blade 1½ or 2 inches long, or the blade wholly obsolete; whorls numerous; pedicels 4 to 12 lines long; petals orbicular with truncatish or broadly subcordate base, 7 to 10 lines broad, broader than long; stamens 22 to 30, the filaments about as long as the anthers, dilated at base; achenes with acute margins, the sides with an ear-shaped depression margined by a narrow wing and with one or two tube-like passages in the spongy pericarp near the ventral angle.

Lower San Joaquin River islands and shores: Lathrop (*K. Brandegee*, Sept. 1907, fls. & fr.) to Stockton.

Refs.—SAGITTARIA GREGGII J. G. Sm. Rep. Mo. Bot. Gard. 6: 43, pl. 12 (1894), type loc. Stockton, *Sanford*, July, 1893; Smith, l. c., says that a plant collected by Dr. J. Gregg at Zamora, Michoacan, Mexico, seems to be the same as the Californian plant.

4. **S. sanfordii** Greene. Leaves 2 to 3 feet long; petioles obtusely triquetrous, ½ to 1½ inches thick at the base; blades linear- to oblong-lanceolate, 4 or 5 inches long, tapering into the spongy petiole, or almost obsolete in submersed plants; scapes stout, 1½ feet high or more; whorls of flowers usually few; sepals ovate, 2 to 3 lines long; achenes 1 line long, winged on both the inner and outer margins, the sides reticulated; beak nearly erect, short, triangular.

Sloughs and pools, lower San Joaquin River. About 100 acres of pure growth occurs just below the San Joaquin Bridge near Banta.

Refs.—SAGITTARIA SANFORDII Greene, Pitt. 2: 158 (1890); J. G. Sm. Rep. Mo. Bot. Gard. 6: 57, pl. 28 (1894); K. Brandegee, Zoe, 4: 103 (1893).

5. **S. montevidensis** C. & S. Stout; leaves sagittate, strongly many-ribbed; flowers 1 to 1¼ inches broad; petals white, with a brownish purple spot at base; fruiting heads of achenes very large, ¾ to 1¼ inches in diameter.

Introduced at Stockton and Penryn.

Refs.—SAGITTARIA MONTEVIDENSIS C. & S. Linnaea, 2: 156 (1827); J. G. Sm. Rep. Mo. Bot. Gard. 6: 57, pl. 29 (1895); Eastwood, Erythea, 7: 150 (1899).

HYDROCHARITACEAE. FROG'S BIT FAMILY.

Aquatic herbs with dioecious or polygamous regular flowers from a spathe. Stamens 3 to 12. Ovary 1 to 3-celled, inferior; stigmas 3 or 6. Fruit maturing under water, many-seeded, indehiscent.—Genera 14, all continents.

1. ELODEA Michx.

Perennial herbs. Leaves opposite or whorled, crowded, sessile, pellucid. Flowers polygamo-dioecious, solitary and sessile, arising from a tubular 2-cleft axillary spathe. Staminate flowers minute, with 6-parted perianth (3 sepals, 3 petals), and 9 short stamens. Pistillate flowers with 3 calyx-lobes and 3 petals, its long calyx-tube at base coherent with the ovary; ovary 1-celled, with 3 parietal placentae; style capillary, coherent with calyx-tube; stigmas 3; stamens 3 (sometimes rudimentary) or 6.—Species about 5, North and South America. (Greek elodes, marshy.)

1. **E. canadensis** Michx. WATER-WEED. Stems slender, elongated, submerged, ¼ to 2 feet long, varying according to depth of the water; leaves lanceolate to ovate or linear, 1 to 3 lines long; staminate flowers breaking off in anthesis, rising to the surface and shedding their pollen around the pistillate ones; pistillate flowers rising to and expanding on the surface by means of the elongated (2 to 10 inches long) calyx-tube.

Rare in California: Mendocino Co., acc. Bot. Cal.; Truckee, *K. Brandegee*; Egg Lake, Modoc Co., *Baker*. Nearly throughout North America.

Refs.—ELODEA CANADENSIS Michx. Fl. Bor. Am. 1: 20 (1803); *Anacharis canadensis* Planchon; Wats. Bot. Cal. 2: 129 (1880).

Jepson, Fl. Cal. vol. 1, pp. 65-81, Apr. 22, 1912.

GRAMINEAE[1].

By A. S. Hitchcock,

Systematic Agrostologist, U. S. Department of Agriculture.

Mostly herbaceous plants, with usually hollow stems (culms) closed at the nodes, and 2-ranked leaves. Leaves consisting of two parts, the sheath and the blade, the sheath enveloping the culm with the margins usually overlapping, the blade with parallel veins, usually narrowly linear; at the junction of the sheath and blade on the inside, a membranaceous or hyaline appendage, the ligule. Inflorescence paniculate or contracted into racemes or spikes, the branches usually bractless. Flowers usually perfect, small, without a distinct perianth, arranged in spikelets consisting of a shortened axis (rachilla) and 2 to many distichous bracts, the lowest pair (the glumes) empty, each succeeding bract (the lemma) including a single flower and, with its back to the rachilla, a 2-nerved bract or prophyllum (the palea), the flower and its lemma and palea being called the floret. At the base of the flower, between it and the lemma, two small hyaline scales (the lodicules), rarely a third lodicule between the flower and the palea. Stamens usually 3, with delicate filaments and 2-celled versatile anthers. Pistil 1, with a 1-celled 1-ovuled ovary, usually 2 styles and usually plumose stigmas. Fruit a caryopsis with starchy endosperm and a small embryo at the base, on the side opposite the hilum. Grain usually inclosed at maturity in the lemma and palea, free or adnate to the palea.

The stems are woody in bamboos (cultivated in California for ornament) and in a few other groups, and are solid in corn, sorghum and some other large grasses. The sheath is sometimes grown together at the margins, as in Melica and Glyceria. The blade in some tropical grasses is broad or even cordate, and there is occasionally a short petiole above the sheath. The flowers may be monoecious as in the cultivated corn, or dioecious, as in Distichlis and Monanthochloë. One or both of the glumes may be wanting, as in Paspalum and Leersia. The lemma may be sterile, that is, it may contain only stamens, or only the palea, or the latter may be reduced or wanting, or the lemma itself may be variously modified or reduced, as in the upper florets of Melica, or Bouteloua. The stamens are rarely 1, 2, or 6, and the styles are rarely 1 or 3. The seed is free from the thin pericarp in Sporobolus, Eleusine, Crypsis and Heleochloa.—A large family of about 500 genera distributed throughout the world, in all latitudes and altitudes where are found conditions suitable for plant growth, but least abundant in dense tropical forests.

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Unless otherwise stated the specimens cited are in the National Herbarium. Readers are especially cautioned against being misled by discrepancies in the numbers, as it occasionally happens that a specimen in the National Herbarium under a given number differs from specimens in other herbaria under the same number. Furthermore there are some irregularities in the numbering of certain series of specimens in the National Herbarium. Davy & Blasdale's numbers are often duplicated on specimens credited to Davy. Specimens collected by Heller & Brown were also distributed as collected by Heller. The data for many specimens collected by Davy in Monterey Co. and elsewhere are placed on labels with a printed heading, "Del Norte, Humboldt and Mendocino Counties." This is misleading only when the locality is not given, or is obscure or local, or is not to be found in the atlases. It is to be regretted that collectors have so often omitted the habitat from the labels. The keys to tribes and genera are based upon the groups as represented in California. Jepson's Flora of Western Middle California, second edition, 1911, has not been cited under references except when it differs from the first.—A. S. Hitchcock.

Bibliog.—Bentham & Hooker, Gen. Pl. 3: 1074. 1883. Hackel in Engler & Prantl, Pflanzenfam. 2^2: 1. 1887 (with several supplements). The True Grasses, Scribner & Southworth, 1890 (a translation of the preceding). Beal, Grasses N. Am. 2 vols. 1896 (systematic portion in second volume). For cultivated grasses see article on Gramineae in Bailey's Cycl. Agric., and articles on individual genera in Bailey's Cycl. Hort.; also Farm Grasses of U. S. by Spillman, and various bulletins of the U. S. Dept. Agr. Div. Agrost., especially Bull. 14, Economic Grasses. The following more recent articles or monographs include references to California: Vasey, Illustr. N. Am. Grasses, Vol. 1, Grasses of the Southwest (U. S. Dept. Agr. Div. Bot. Bull. 12. in 2 pts. 1891); Vol. 2, Grasses of the Pacific Slope (op. cit. Bull. 13, in 2 pts. 1893). U. S. Dept. Agr. Div. Agrost. Bull. 4. 1897, including revision of Hordeum and Agropyron, by Scribner & Smith; Bull. 7, American Grasses I, Bull. 17, American Grasses II, Bull. 20, American Grasses III, the latter being an account of the genera of N. A. grasses (all by Scribner); Bull. 11, 1898, including a revision of Calamagrostis by Kearney; Bull. 18, 1899, a revision of Sitanion by J. G. Smith; Bull. 21, 1900, a revision of Chaetochloa by Scribner & Merrill; Bull. 23, 1900, a revision of Bromus by Shear, U. S. Dept. Agr. Bur. Pl. Ind. Bull. 9, 1902, a revision of Spartina by Merrill; Bull. 33, 1903, a revision of Leptochloa by Hitchcock; Bull. 68, 1905, a revision of Agrostis by Hitchcock. Contr. Nat. Herb. Vol. 3, pp. 1-89. 1892, a Monograph of the Grasses of the United States by Vasey, including the tribes Maydeae to Agrostideae; Vol. 10, pp. 1-48. 1906, a revision of Festuca by Piper; Vol. 11, 1906, a Flora of the State of Washington by Piper; Vol. 14, pp. 343-428, 1912, the Grama Grasses by Griffiths; Vol. 15, 1910, a revision of Panicum by Hitchcock & Chase. Bolander, Genus Melica in California (Proc. Cal. Acad. 4: 89-104. 1870), Genus Stipa in California (op. cit. 168-170. 1872). Scribner, Revision N. A. Melicae (Proc. Acad. Phila. 1885: 40-48. 1885).

SUBFAMILY I. PANICOIDEAE.

Spikelets with 1 perfect flower, or with a second staminate or neutral flower below. Rachilla articulated below the glumes, the more or less dorsally compressed spikelets falling from the pedicels entire, singly, in groups, or together with joints of an articulate rachis.

Spikelets in pairs (or the terminal in 3's) one sessile or nearly so and fertile, the other pediceled; lemmas hyaline.............................TRIBE I. ANDROPOGONEAE.

Spikelets not in pairs (in certain genera spikelets paired but lemmas firmer than glumes).

Spikelets in groups at each joint of the main axis, falling off entire; outer glumes larger than the florets...TRIBE II. ZOYSIEAE.

Spikelets not in groups, falling singly; outer or first glume smaller than the floret. TRIBE III. PANICEAE.

SUBFAMILY II. POACOIDEAE.

Spikelets 1 to many-flowered, the imperfect or rudimentary floret, if any, uppermost (or if below the fertile one, the spikelet strongly laterally compressed); rachilla usually articulated above the glumes, these persistent on the pedicel or rachis after the fall of the florets; spikelets more or less laterally compressed. The spikelets are articulated below the glumes in Alopecurus, Cinna, Polypogon, Notholcus, Sphenopholis, Spartina and Beckmannia, but these genera are distinguished from Subfamily I by the laterally compressed spikelets.

Spikelets more or less pediceled, in open or contracted panicles, these sometimes spike-like but not 1-sided.

Spikelets with 1 perfect flower, with sometimes a pair of sterile or staminate florets below.

Spikelets with 1 perfect terminal flower and a pair of sterile or staminate florets below, these sometimes reduced to minute bristles.........TRIBE IV. PHALARIDEAE.

Spikelets 1-flowered, the rachilla sometimes prolonged behind the palea as a naked or plumose bristle.....................................TRIBE V. AGROSTIDEAE.

Spikelets 2 to several-flowered.

Awn usually present, often twisted, borne on the back of the lemma or between the teeth of the bifid apex (awnless in Sphenopholis and Koeleria); glumes usually longer than the first floret; rachilla prolonged behind the palea of the uppermost floret...TRIBE VI. AVENEAE.

Awn, when present, terminal, usually straight (the apex of the lemma bifid in Bromus, and in certain species of Festuca and Melica); glumes usually shorter than the first floret.......................................TRIBE VIII. FESTUCEAE.

Spikelets sessile or nearly so, in spikes, 1 to several-flowered.

Spikelets in 1-sided spikes, usually closely imbricated; spikes digitate or racemose...... TRIBE VII. CHLORIDEAE.

Spikelets sessile on opposite sides of a more or less zigzag jointed channeled rachis, forming a terminal spike; leaf-blades bearing at base a more or less well-marked pair of auriculate appendages..TRIBE IX. HORDEAE.

Tribe I. Andropogoneae. Spikelets in pairs (or the terminal in 3's) on the usually articulate rachis of a spike-like raceme, one sessile and fertile, the other pediceled and perfect, staminate, neuter or reduced to a rudiment. Glumes more or less indurated. Lemmas smaller than the glumes, hyaline, that of the fertile floret usually awned.

Spikelets awnless..1. IMPERATA.

Spikelets awned.

Spikelets in pairs, in racemes, these aggregated in a dense inflorescence...3. ANDROPOGON.

Spikelets in 3's, in an open panicle.....................................2. HOLCUS.

Tribe II. Zoysieae. Spikelets in groups, each group falling as a whole from the axis; glumes firmer than the lemma, the first usually larger than the second; spikelets 1 or 2-flowered, perfect or with staminate spikelets intermixed. Only one genus, Pleuraphis (no. 4), in California. To this tribe belongs the Korean lawn grass (Zoysia pungens Willd.), occasionally cultivated for lawns..............................4. PLEURAPHIS.

Tribe III. Paniceae. Spikelets all alike, the first glume when present, shorter than the floret, the first or lower lemma similar to the glumes in texture, enclosing a staminate flower, or only a palea, or entirely empty, the second or upper lemma and palea indurated, enclosing a perfect flower and persisting as a covering to the fruit.

Spikelets not surrounded by bristles.

Fruit cartilaginous-indurated, the margins of the lemma not inrolled; inflorescence of slender, more or less digitate, spike-like racemes; our species annual...5. DIGITARIA.

Fruit indurated, the margins inrolled; inflorescence paniculate or spike-like, not digitate in our species.

Spikelets plano-convex, imbricated in spike-like racemes..............6. PASPALUM.

Spikelets not conspicuously plano convex.

Fertile palea included at tip; fruit not pointed; inflorescence paniculate..7. PANICUM.

Fertile palea free at tip; fruit pointed; spikelets in racemes, these in panicles...... 8. ECHINOCHLOA

Spikelets subtended or surrounded by bristles (sterile branchlets)..........9. SETARIA.

Tribe IV. Phalarideae. Spikelets with 1 terminal perfect floret and a pair of sterile florets below, the group articulated above the glumes and falling entire; sterile florets sometimes staminate, but usually small, or reduced to mere rudiments or pedicels.

Glumes strongly compressed, boat-shaped; sterile lemmas empty, narrow, bristle-form or scale-like, much shorter than the indurated fertile lemma............10. PHALARIS.

Glumes not strongly compressed or boat-shaped; sterile lemmas ovate or oblong, longer than the fertile lemma.

Sterile lemmas, empty, dorsally awned; inflorescence spike-like......11. ANTHOXANTHUM.

Sterile florets staminate; inflorescence a somewhat open panicle........12. HIEROCHLOË.

Tribe V. Agrostideae. Spikelets 1-flowered, the rachilla sometimes prolonged behind the palea as a naked or plumose bristle; glumes usually as long as or longer than the lemma.

Lemma indurated, usually long-awned, a well marked callus at base.

Awn trifid ....13. ARISTIDA.

Awn simple.

Awn geniculate and twisted, usually more than ½ inch long..............14. STIPA.

Awn straight or curved, less than ½ inch long......................15. ORYZOPSIS.

Lemma membranaceous (rather firm in Muhlenbergia), usually more delicate than the glumes.

Inflorescence a flat-topped head, subtended by 2 inflated sheaths...........17. CRYPSIS.

Inflorescence sometimes capitate but not flat-topped.

Lemma awned or mucronate from the tip.....................16. MUHLENBERGIA.

Lemma awnless or dorsally awned.

Glumes conspicuously compressed-carinate; spikelets in dense spike-like panicles.

Lemma awnless; glumes abruptly aristate.........................18. PHLEUM.

Lemma awned below the middle; glumes not aristate...........19. ALOPECURUS.

Glumes not conspicuously compressed.
Pericarp loosely enclosing the seed; inflorescence an open panicle..20. Sporobolus.
Pericarp adherent to the seed; inflorescence open or contracted.
Glumes long-awned ....22. Polypogon.
Glumes awnless, or short awned.
Inflorescence a long slender dense spike-like panicle.........21. Epicampes.
Inflorescence often contracted but not conspicuously elongated.
Palea 1-nerved, or apparently so..............................23. Cinna.
Palea plainly 2-nerved (sometimes nerveless or wanting).
Glumes plumose-ciliate; inflorescence an ovoid head.......28. Lagurus.
Glumes not plumose.
Glumes saccate at base, much longer than the lemmas..25. Gastridium.
Glumes not saccate at base.
Rachilla not prolonged behind the palea (except in A. thurberiana); callus hairs short or none (except in A. hallii)....24. Agrostis.
Rachilla prolonged behind the palea as a usually hairy bristle.
Lemma awned from the back; callus hairs long.................
26. Calamagrostis.
Lemma awnless; callus hairs short.............27. Ammophila.

Tribe VI. Aveneae. Spikelets 2 to several-flowered, in open or contracted panicles; rachilla prolonged behind the uppermost floret (except in Aira); glumes usually longer than the first floret; 1 or more of the lemmas awned on the back or from the teeth of the bifid apex (usually awnless in Koeleria and Sphenopholis); callus and usually the rachilla joints hairy.

Rachilla not prolonged; spikelets 2-flowered, perfect........................30. Aira.
Rachilla prolonged behind the uppermost floret; spikelets 2 to several-flowered.
Articulation below the glumes, the spikelets falling entire or the glumes and lowest florets together.
Glumes much exceeding the 2 florets; spikelet awned..............29. Notholcus.
Glumes exceeded by the upper floret; spikelet awnless............33. Sphenopholis.
Articulation above the glumes.
Awns wanting or but a mucronate tip...........................34. Koeleria.
Awns present.
Awns from between the teeth of the bidentate apex of the lemma, flattened, twisted
36. Danthonia.
Awns dorsal, not flattened.
Lemmas more than ½ inch long...................................35. Avena.
Lemmas less than ½ inch long.
Lemmas keeled; awn from above the middle..................32. Trisetum.
Lemmas convex; awn from below the middle..............31. Deschampsia.

Tribe VII. Chlorideae. Spikelets 1 to several-flowered, sessile in 1-sided spikes; spikes digitate or racemose; lemma awnless or awned from between teeth; spikelets usually compressed and closely imbricated (more distant and often slightly pediceled in Leptochloa).

Spikes digitate.
Plants perennial, extensively creeping..............................37. Cynodon.
Plants annual, more or less spreading but not creeping.
Perfect florets 2 or more, awnless.................................42. Eleusine.
Perfect floret 1 (long-awned).......................................39. Chloris.
Spikes racemose.
Spikelets 1-flowered.
Glumes narrow, unequal ....38. Spartina.
Glumes broad, boat-shaped, equal................................41. Beckmannia.
Spikelets with more than 1 floret.
Lemmas 3-awned; spikelets imbricated, with only 1 perfect floret.......40. Bouteloua.
Lemmas 1-awned or awnless; spikelets somewhat distant, with 3 to several perfect florets ....43. Leptochloa.

Tribe VIII. Festuceae. Spikelets 2 to many-flowered, pedicellate in racemes or in open or contracted panicles (spikes in Orcuttia; solitary in Monanthochloë); glumes usually shorter than the first lemma; lemmas awnless or with a straight (rarely bent) awn, terminal or from between the teeth of a bidentate apex.

Spikelets of two kinds in the same inflorescence, perfect and sterile; spikelets fasciculate in 1-sided panicles ....57. LAMARCKIA.

Spikelets all alike in the same inflorescence.

Plants dioecious; perennials with creeping rhizomes or stolons (a few species of Poa are dioecious).

Spikelets solitary, concealed in the axils of short crowded rigid leaves.............. 44. MONANTHOCHLOË.

Spikelets in exserted panicles..................................54. DISTICHLIS.

Plants not dioecious.

Rachilla or lemmas provided with long hairs exceeding the glumes in length; tall reeds.

Hairs on lemmas, the rachilla naked...........................46. ARUNDO.

Hairs on the rachilla only...................................47. PHRAGMITES.

Rachilla and lemmas naked or the hairs shorter than the glumes.

Spikelets sessile, in short terminal spikes; lemmas 5-toothed; low annual........ 45. ORCUTTIA.

Spikelets in racemes or in open or contracted panicles.

Lemmas 3-nerved.

Lemmas pilose on the nerves, longer than the glumes; callus densely villous. 48. TRIDENS.

Lemmas sometimes pubescent but not pilose on the nerves; callus not villous.

Glumes equaling or exceeding the spikelet..............49. DISSANTHELIUM.

Glumes shorter than the first floret.......................50. ERAGROSTIS.

Lemmas 5 to many-nerved.

Spikelets nearly sessile in dense 1-sided clusters at the ends of the few panicle branches...56. DACTYLIS.

Spikelets not in dense 1-sided clusters.

Lemmas flabelliform, many-nerved, petal-like ....51. ANTHOCHLOA.

Lemmas not flabelliform.

Palea appendaged on the keels; inflorescence a simple raceme......... 53. PLEUROPOGON.

Palea not appendaged.

Spikelets very broad, much compressed, cordate; lemmas cordate..... 55. BRIZA.

Spikelets not broad and cordate.

Lemmas keeled, awnless (keeled in some species of Bromus but the bifid tip acuminate or awned)........................58. POA.

Lemmas convex or keeled only at summit.

Glumes large, membranaceous or papery, scarious-margined; upper 2 or 3 lemmas empty, convolute around each other..52. MELICA.

Glumes not scarious-margined; upper lemmas not empty and convolute around each other.

Nerves of lemmas 5 to 9, parallel, prominent.......59. GLYCERIA.

Nerves of lemmas not prominent, or not equally so.

Lemmas obtuse, awnless, scarcely nerved.....60. PUCCINELLIA.

Lemmas acute or awned, or, if obtuse, awned between the teeth of the bifid apex.

Lemmas entire, acute or awned from the apex (very narrow teeth in F. elmeri etc)...................61. FESTUCA.

Lemmas bifid at apex (except B. brizaeformis), the awn if present from between the teeth............62. BROMUS.

Tribe IX. Hordeae. Spikelets 1 to several-flowered (the uppermost floret imperfect), sessile on opposite sides of a flattened or channeled rachis forming a spike; glumes sometimes small or wanting, sometimes placed in pairs in front of the spikelet; auricular appendages borne at the top of the sheath on each side at base of blade.

Spikelets solitary at each joint of the rachis (occasionally double in Agropyron).

Spikelets placed edgewise to the rachis, the lateral ones with a single glume.

Spikelets several flowered ....63. LOLIUM.

Spikelets 1-flowered ....64. MONERMA.

Spikelets placed flatwise to the rachis, all with 2 glumes.
Spikelets several-flowered ....67. Agropyron.
Spikelets 1-flowered; spikes very slender.
Lemma awnless ....65. Lepturus.
Lemma awned ....66. Scribneria.
Spikelets, at least some of them, in 2's or 3's at each joint of the rachis.
Spikelets 1-flowered, not all alike, in 3's, the lateral pair pediceled........68. Hordeum.
Spikelets 2 to 6-flowered, all alike, usually in 2's.
Glumes minute or wanting; spikes loose..........................71. Hystrix.
Glumes about as large as the lemmas; spikes dense.
Axis of spike continuous, not disarticulating at maturity; glumes broad or narrow but not greatly elongated..69. Elymus.
Axis of spike disarticulating at maturity; glumes usually setaceous and elongated. 70. Sitanion.

Tribe I. ANDROPOGONEAE.

1. IMPERATA Cyrillo.

Spikelets 1-flowered, in pairs, all alike, unequally pedicellate, articulated with the pedicels, densely clothed with long silky hairs. Glumes 2, membranaceous, long-villous. Sterile and fertile lemmas membranaceous, glabrous, the latter narrow, its palea broad, truncate, toothed, surrounding the ovary. Erect perennial grasses with densely villous spike-like terminal panicles.—Warm regions of the world, about 5 species. (The Italian naturalist Ferrante Imperate.)

1. **I. hookeri** Rupr. Culms erect from creeping rhizomes, 3 to 5 feet high, glabrous; sheaths glabrous; ligule long-villous; blades elongated, the lower narrowed at the long conduplicate base, 4 to 6 lines wide, acuminate, glabrous, the upper shorter, the uppermost much reduced; panicle dense, 6 to 12 inches long pale or tawny, or somewhat rose-tinted, soft, silky; spikelets about 1½ lines long, clothed with hairs twice as long.

Desert regions, from southern California to New Mexico and south into Mexico.

Locs.—Tulare Co., *Palmer* 2748 in 1892; Inyo Co., *Coville & Funston* 219, 240; San Bernardino, *Parish Bros.* 1031; Colorado Desert, *Wilder* 1077.

Ref.—Imperata hookeri Rupr.; Andersson, Öfv. Vet. Akad. Förh. 12: 160. 1855.

Eremochloa leersioides Hack. in DC. Monogr. Phan. 6: 264. 1889. *Ischaemum leersioides* Munro, Proc. Am. Acad. 4: 363. 1860; Thurb. in Wats. Bot. Cal. 2: 262. 1880. Thurber states that this was "collected in San Francisco, near a Chinese Warehouse, *Bolander*." It is a native of China and has not since been collected.

2. HOLCUS L.

Spikelets in 3's, terminating the branchlets of the panicle, the central spikelet 1-flowered, sessile, perfect, the lateral pedicellate, staminate. Glumes 2, hard and shining. Sterile lemma hyaline. Fertile lemma small and thin, bearing a geniculate awn. Palea minute. Annual or perennial grasses with terminal, open or contracted panicles.—Species 2, natives of the Old World, one, H. Sorghum L. (Andropogon sorghum Brot.; Sorghum vulgare Pers.), being widely cultivated under the name of Sorghum, Cane, Milo Maize, Durra, Kafir etc. (An old Latin name for a grass, probably from the Greek holcos, attractive.)

1. **H. halepensis** L. Johnson Grass. An erect glabrous robust plant, with extensively creeping rhizomes; culms 2 to 4 feet high; blades flat, 3 to 9 lines wide, the midrib prominent, white; panicle 6 to 10 inches long, more or less spreading; fertile spikelets about 2½ lines long, the glumes pubescent, becoming glabrate and shining; staminate spikelets narrow, 2 lines long, on pedicels 1½ lines long, the glumes membranaceous, nerved, glabrous.

Introduced from the Old World. Occasional from Santa Barbara southward along the coast. A valuable forage grass but having a tendency to become a troublesome weed.

Locs.—Santa Barbara, *Chase* 5612; Pasadena, *Grant* 4133; Santa Ana, *Abrams* 1765; Escondido, *Chandler* 5351.

Refs.—HOLCUS HALEPENSIS L. Sp. Pl. 1047. 1753. *Andropogon halepensis* Brot. Fl. Lusit. 1: 89. 1804. *A. sorghum* Brot. var. *halepensis* Hack. in DC. Monogr. Phan. 6: 502. 1889; Davy in Jepson, Fl. W. Mid. Cal. 29. 1901. *Sorghum halepense* Pers. Syn. 1: 101. 1805; Abrams, Fl. Los Ang. 21. 1904.

3. ANDROPOGON L.

Spikelets in pairs (or the terminal in 3's) at each joint of the articulate and usually hairy rachis, one sessile, perfect, 1-flowered, the other pedicellate, staminate, neutral, or reduced to a pedicel. Glumes of fertile spikelet 2, the first more or less indurated, flattened on the back, with 2 prominent nerves near the margin, the central less prominent, the second glume as long as the first, keeled. Sterile and fertile lemmas hyaline, the latter awned. Palea minute or wanting. Annual or perennial, usually coarse grasses with terminal and often axillary inflorescence of one to many spikes.—Species numerous, probably about 200, widely distributed in both hemispheres, except the colder regions. (Greek, aner, man, and pogon, beard, referring to the hairy rachis.)

1. **A. barbinodis** Lag. Culms tufted, erect or somewhat spreading at base, 2 to 4 feet high, glabrous except the densely ascending-hispid nodes; sheaths glabrous; blades 1½ to 3 lines wide, flat, scabrous above, the upper much reduced; panicle 2 to 3 inches long, consisting of several appressed or ascending silky-white racemes, somewhat flabellately aggregated near the summit of the culm; glumes of sessile spikelet 2½ lines long, the awn about 10 lines long, geniculate at the middle, tightly twisted below the bend, loosely twisted above.

Dry hills from Santa Barbara to San Diego, east to New Mexico and south into Mexico.

Locs.—Santa Barbara, *Elmer* 3760; Los Angeles, *Grant* 3461; Santa Monica Mts., *Abrams* 3110; Santa Catalina Island, *Trask;* San Diego, *Baker* 3406.

Refs.—ANDROPOGON BARBINODIS Lag. Gen. & Sp. Nov. 3. 1816. *A. saccharoides* [Swartz, misapplied by] Abrams, Fl. Los Ang. 21. 1904.

TRIBE II. ZOYSIEAE.

4. PLEURAPHIS Torr.

Spikelets in 3's at each joint of the inarticulate rachis, villous at base, all sessile and falling off together. Central spikelet 1-flowered, perfect; glumes 2, the summit cleft into several awn-like divisions. Lateral spikelets staminate, 1 or 2-flowered. Perennial, wiry or woody grasses with creeping rhizomes and terminal spikes.—Species 3, in the Sonoran region. (Greek pleura, side, and raphis, needle, referring to the awn on the side of the glume in the type species, P. jamesii.)

Culms felty-pubescent ....1. *P. rigida.*
Culms glabrous or slightly puberulent ....2. *P. jamesii.*

1. **P. rigida** Thurb. Culms numerous, felty-pubescent, glabrate and scabrous above, 1½ to 3 feet high; leaves felty or glabrous, usually woolly around the top of the sheath; blades 1 to 2 inches long, or longer on sterile shoots, 1 to 2 lines wide, more or less involute, acuminate into a rigid coriaceous point; spikelets about 4 lines long; glumes of central spikelet broadened upward from a narrow base, woolly-ciliate, several-awned from the tip, a stronger dorsal awn from about the middle; lemma 3-nerved, enclosing the palea and a rudimentary second floret, the nerves villous on the back, extending into deli-

cate awns between the ciliate lobes of the apex; lateral spikelets similar, narrower, the glumes less awned at the tip, the second floret similar to the first.

Mohave and Colorado deserts, east to Arizona and south into Mexico.

Locs.—Palm Springs, *Parish* 4145; Whitewater, *Parish Bros.* 880; Newberry, *Chase* 5787; Barstow, *Hall & Chandler* 6844; Mountain Spring, *Schoenfeldt* 3082; San Felipe, *Brandegee* 89; San Jacinto Mts., *Hall* 2118.

Refs.—Pleuraphis rigida Thurb. in Wats. Bot. Cal. 2: 293. 1880. *Hilaria rigida* Benth.; Scribn. Bull. Torr. Club 9: 33. 1882.

2. **P. jamesii** Torr. Galleta. Culms glabrous, the nodes villous; sheaths glabrous or slightly scabrous, sparingly villous around the short membranaceous ligule; blades mostly 1 to 2 inches long, 1 to 2 lines wide, rigid, soon involute, the upper reduced; spikelets 3 to 4 lines long, long-villous at base; glumes of central spikelet pubescent, cuneate, 2-lobed, the lobes 2 or 3-awned, the central nerve between, extending from below the middle into an awn somewhat longer than the others, the awns all minutely plumose; lemma erose at apex, glabrous, 3-nerved, the nerves parallel, the central extending into a short awn; glumes of lateral spikelets narrow, pubescent, the first unsymmetrical, 5-nerved, the second nerve on one side extending into a dorsal awn from below the middle, the apex unequally 2-lobed, the sinus extending down about half-way to the point of departure of the awn, the lobes minutely ciliate; second glume 5-nerved, awnless, entire, ciliate, conduplicate around the floret; lemma as in fertile spikelet; stamens 2.

Deserts of Inyo Co.: Argus Mts., *Hall & Chandler* 7086; Coso Mts., *Coville & Funston* 915. Extends east to Wyoming and Texas, and south into Mexico.

Refs.—Pleuraphis jamesii Torr. Ann. Lyc. N. Y. 1: 148. pl. 10. 1824. *Hilaria jamesii* Benth. Jour. Linn. Soc. Bot. 19: 62. 1881.

Tribe III. PANICEAE.

5. DIGITARIA Scop.

Spikelets with 1 perfect flower, sessile or short-pediceled, solitary or in 2's or 3's, in 2 rows on 1 side of a continuous narrow or winged rachis, forming slender spike-like racemes, aggregated toward the summit of the culm. Glumes 1 to 3-nerved, the first small, sometimes obsolete. Sterile lemma 5-nerved, membranaceous. Fertile lemma leathery-indurated, papillose-striate, with a flat hyaline margin. Annual or perennial, mostly weedy grasses with subdigitate inflorescence.—Species about 50, mostly natives of the warmer parts of the Old World, several species being introduced weeds in the New World. (Greek digitus, a finger.)

1. **D. sanguinalis** Scop. Crab-grass. Annual, usually much-branched at base; culms 1 to 3 feet long, geniculate-spreading, or creeping and rooting at the nodes, the flower-stalks more or less erect; sheaths more or less papillose-hirsute; blades lax, 3 to 5 inches long, 2 to 5 lines wide, often pilose; racemes 3 to 12, subdigitate, 2 to 5 inches long; rachis with lateral angles winged; spikelets in pairs, $1\frac{1}{2}$ to $1\frac{3}{4}$ lines long, usually appressed-pubescent between the smooth or scabrous nerves; pedicels angled; first glume minute; second glume about $\frac{1}{2}$ as long as the spikelet.

A native of the Old World, now a common weed in the warmer parts of the western hemisphere. Cultivated soil and waste places, central and southern parts of the state, especially in the interior valleys.

Refs.—Digitaria sanguinalis Scop. Fl. Carn. ed. 2. 1: 52. 1772. *Panicum sanguinale* L. Sp. Pl. 57. 1753; Thurb. in Wats. Bot. Cal. 2: 258. 1880; Davy in Jepson, Fl. W. Mid. Cal. 31. 1901. *Syntherisma sanguinalis* Dulac, Fl. Haut. Pyr. 77. 1867; Abrams, Fl. Los Ang. 23. 1904.

6. PASPALUM L.

Spikelets 1-flowered, plano-convex, nearly sessile, placed with the back of the fertile lemma toward the rachis, solitary or in pairs, in 2 rows on 1 side of a continuous narrow or dilated rachis, forming simple spike-like racemes. First glume usually obsolete (often present in our species). Second glume and sterile lemma membranaceous, about as long as the indurated fertile lemma. Perennials, with 1 to several racemes at the summit of the culm and branches.—Species numerous, probably 200, in the warmer parts of both hemispheres. (Paspalos, a Greek name for millet.)

1. **P. distichum** L. Culms erect from a decumbent rooting base, with numerous creeping rhizomes, glabrous, or the nodes pubescent, 1 to 2 feet high; sheaths glabrous or sometimes pubescent; blades flat, glabrous, rarely pubescent, 2 to 4 inches long, the upper shorter; racemes 2, the second 4 to 5 lines below the first, sometimes a third below the second, more or less pilose at base, slender, ascending or appressed, usually 1 to 2 inches long; spikelets elliptical, 1½ lines long; first glume sometimes wanting, sometimes nearly as long as spikelet, glabrous; second glume pubescent; sterile lemma glabrous.

Along the seacoast (Crescent City, *Davy & Blasdale* 5937) and in ditches and wet places in the interior, central and southern portions of the state (Merced, *Hitchcock* 3211; Los Angeles, *Grant* 1196); rarely northward. Common in tropical America and extending north in the Eastern coastal plain as far as Virginia.

Refs.—PASPALUM DISTICHUM L. Syst. Nat. ed. 10. 2: 855. 1759; Thurb. in Wats. Bot. Cal. 2: 257. 1880; Davy in Jepson, Fl. W. Mid. Cal. 30. 1901; Abrams, Fl. Los Ang. 22. 1904. *Panicum polyrhizum* Presl, Rel. Haenk. 1: 296. 1830, the type from "Monte-Rey", Cal., is in the herbarium of the German University at Prague.

7. PANICUM L.

Spikelets with 1 perfect flower and a staminate or neutral flower below. Glumes unequal, first often minute, second usually about equaling the sterile lemma, the latter usually enclosing a palea and sometimes a staminate flower. Fertile lemma and palea indurated, the former inrolled at the margins. Annuals or perennials of various habit, with spikelets borne in panicles.—Species numerous, probably 350, in the warmer regions of both hemispheres. (An ancient Latin name for the millet, Setaria italica.)

Plants annual.
  Fruit transversely rugose ....1. *P. arizonicum.*
  Fruit smooth.
    First glume not over ¼ the length of the spikelet, truncate or broadly triangular; sheaths smooth ....2. *P. dichotomiflorum.*
    First glume as much as ½ the length of the spikelet, acute or acuminate; sheaths hispid.
      Panicle drooping ....6. *P. miliaceum.*
      Panicle erect.
        Panicle more than ½ the length of the entire plant.
          Spikelets 1 to 1¼ lines long............................3. *P. capillare.*
          Spikelets 1½ to 1⅞ lines long............................4. *P. barbipulvinatum.*
        Panicle not more than ⅓ the entire height of plant; spikelets 1⅜ to 1⅝ lines long. 5. *P. hirticaule.*
Plants perennial.
  Spikelets 3 to 3½ lines long............................7. *P. urvilleanum.*
  Spikelets ¾ to 1⅝ lines long.
    Spikelets turgid, strongly nerved, sparsely hispid, 1⅝ lines long...14. *P. scribnerianum.*
    Spikelets not turgid or strongly nerved, pubescent, not over 1½ lines long.
      Spikelets about 1½ lines long............................13. *P. shastense.*

Spikelets not over 1 line long.
  Sheaths glabrous . . . . 8. *P. lindheimeri*
  Sheaths pubescent.
    Plants velvety-pubescent . . . . 12. *P. thermale*
    Plants more or less pubescent but not velvety.
      Vernal blades glabrous above . . . . 10. *P. occidentale.*
      Vernal blades pubescent above.
        Upper surface of blades pilose; autumnal form decumbent-spreading. . . . . 11. *P. pacificum.*
        Upper surface of blades appressed-pubescent; autumnal form erect or ascending . . . . 9. *P. huachucae.*

A. True Panicum. Annuals or perennials of various habit, but not forming winter rosettes of leaves different in appearance from the culm leaves, nor presenting a distinct vernal and autumnal aspect.

1. **P. arizonicum** Scribn. & Merr. Annual; culms usually branching from the base, glabrous except below the panicle, 8 inches to 2 feet high; nodes sometimes slightly pubescent; sheaths glabrous to strongly papillose-pubescent; blades 2 to 6 inches long, 3 to 6 lines wide, glabrous or papillose-hispid beneath; panicles long-exserted, finely pubescent and copiously papillose-hirsute, 3 to 9 inches long, the branches solitary, ascending, few-flowered; spikelets nearly 2 lines long, obovate-elliptical, abruptly pointed, densely hirsute to glabrous, borne on very short appressed branchlets.

Open ground; Jamacha, San Diego Co., *Canby* (the only California specimen seen) to western Texas and south into southern Mexico.

Ref.—Panicum arizonicum Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Circ. 32: 2. 1901.

2. **P. dichotomiflorum** Michx. Annual, usually much-branched from a geniculate base, smooth throughout; culms rather succulent, 2 to 3 feet high; blades 4 to 20 inches long, about ½ inch wide; panicles 4 to 12 inches long, finally spreading; spikelets 1¼ lines long, narrowly oblong-ovate, acute, faintly 7-nerved, the first glume short, truncate, about ¼ the length of the spikelet.

Low ground and cultivated soil; Fresno, *Bioletti* 140, the only California specimen seen. Common in Eastern U. S.

Refs.—Panicum dichotomiflorum Michx. Fl. Bor. Am. 1: 48. 1803. This species has been incorrectly referred by American botanists to P. proliferum Lam. of the Old World.

3. **P. capillare** L. Old-witch Grass. Annual, erect, 1 to 2 feet high; foliage papillose-hispid; blades 4 to 10 inches long, ¼ to ½ inch wide; panicle large and diffuse, often ½ the length of the entire plant, included at the base until maturity, the whole panicle finally breaking away and rolling before the wind; spikelets about 1 line long, elliptic; first glume acute, ½ as long as spikelet, 5 to 7-nerved.

Open ground, cultivated soil, and river banks, a common weed in Eastern U. S. Pinegrove, Amador Co., *Hansen* 599, the only specimen seen from California.

Refs.—Panicum capillare L. Sp. Pl. 58. 1753. The species described under this name in western floras is usually P. barbipulvinatum.

4. **P. barbipulvinatum** Nash. Closely resembling P. capillare of which it is the western representative, but differing in its stouter habit, shorter, less pubescent blades crowded toward the base of the plant, and especially in the larger spikelets, about 1½ lines long.

Open ground and cultivated soil at moderate altitudes throughout the state and extending from British Columbia to Texas.

Refs.—PANICUM BARBIPULVINATUM Nash in Rydb. Mem. N. Y. Bot. Gard. 1: 21. 1900. This species is described under *P. capillare* in: Thurb. in Wats. Bot. Cal. 2: 258. 1880; Davy in Jepson, Fl. W. Mid. Cal. 32. 1901; Abrams, Fl. Los Ang. 24. 1904.

5. **P. hirticaule** Presl. Annual, erect or nearly so, ½ to 2 feet high, more or less papillose-hispid throughout, especially on the sheaths; blades 2 to 6 lines wide, often sparsely hispid toward the often cordate base; panicle 3 to 6 inches long, scarcely ⅓ the height of the entire plant, open, the branches ascending; spikelets about 1½ lines long, acuminate, usually reddish brown.

Sierra Nevada, *Lemmon* in 1875; San Diego Co. (Jamacha, *Canby* in 1894) to Texas and Central America.

Ref.—PANICUM HIRTICAULE Presl, Rel. Haenk. 1: 308. 1830.

6. **P. miliaceum** L. Annual, as much as 3 feet high; culms and leaves more or less papillose-hispid; panicle 4 to 12 inches long, usually nodding, rather compact, the numerous branches ascending, scabrous, spikelet-bearing toward the summit; spikelets about 2½ lines long, ovate, acuminate, strongly many-nerved; first glume ½ the length of the spikelet, acuminate.

A native of the Old World, cultivated in the U. S. under the name of Hog Millet and Broom-corn Millet. Scattered specimens, introduced or escaped from cultivation, are found throughout the U. S.

Locs.—Kenwood, *Smith* in 1898; Sacramento, *Williams* in 1906; Riverside, *Reed* 3112.

Ref.—PANICUM MILIACEUM L. Sp. Pl. 58. 1753.

P. AGROSTOIDES Spreng. Pl. Pugill. 2: 4. 1815; Thurb. in Wats. Bot. Cal. 2: 258. 1880. In the National Herbarium is a specimen of this species collected by the Wilkes Exploring Expedition, "On the Sacramento." This is far out of its range and the species has not since been collected in California.

7. **P. urvilleanum** Kunth. Plants robust, 2 to 3 feet high, perennial from creeping rhizomes; culms solitary or few in a tuft, the nodes densely bearded but usually hidden by the harshly villous sheaths; blades 2 to 3 lines wide, flat, tapering to a long involute-setaceous point; panicle about a foot long, open; spikelets 3 to 3½ lines long, densely silvery or tawny-villous; first glume acuminate, ⅔ to nearly as long as spikelet.

Sandy deserts, southern California and Arizona, appearing again in Chile and Argentina.

Locs.—Barstow, *Chase* 5766; Hesperia, *Abrams* 2164; Palm Springs, *Wilder* 1082; Edom, *Chase* 5519.

Refs.—PANICUM URVILLEANUM Kunth, Rév. Gram. 2: 403. pl. 115. 1830; Thurb. in Wats. Bot. Cal. 2: 259. 1880. Var. *longiglume* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 17. (ed. 2.): 49. 1901, type from San Jacinto, *Parish Bros.* 887.

B. SUBGENUS DICHANTHELIUM Hitchc. & Chase. Tufted perennials, producing winter rosettes of leaves different in appearance from the culm leaves; vernal culms slender, simple, bearing small open, comparatively few-flowered, terminal panicles; autumnal culms much-branched, presenting a distinct aspect, because of the numerous reduced branches, leaves and panicles.

8. **P. lindheimeri** Nash. Vernal culms stiffly ascending or spreading, 1 to 2 feet high, glabrous, or the lower portion somewhat pubescent; leaves glabrous except the ciliate margin of the lower part of the blades; ligule a ring of cilia 2 to 2½ lines long; panicle 2 to 3 inches long, open; spikelets ¾ line long, obovate, obtuse, turgid, pubescent; autumnal form stiffly spreading or radiate-prostrate, with tufts of short appressed branches at the nodes; blades reduced, involute-pointed, often conspicuously ciliate at the base.

Open ground, chiefly in the Eastern States from Maine to Texas. Rare in California: Sacramento, *Michener* 142; Three Rivers, *Coville & Funston* 1286

Refs. PANICUM LINDHEIMERI Nash, Bull. Torr. Club 24: 196. 1897. *P. funstoni* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Circ. 35: 4. 1901, type *Coville & Funston* 1286.

9. **P. huachucae** Ashe. Vernal form usually stiffly upright, more or less harsh-pubescent throughout; culms 1 to 2 feet high, the nodes bearded; ligule of stiff hairs about 2 lines long; panicle 2 to 3 inches long, the axis and usually the branches pilose; spikelets about $\frac{7}{8}$ line long, obovate, turgid, pubescent; autumnal form stiffly erect, the reduced branches fascicled, the crowded blades ascending.

Open ground, chiefly in the Mississippi Valley, rare in California. San Bernardino Mts., *Abrams* 2737.

Ref.—PANICUM HUACHUCAE Ashe, Jour. Elisha Mitchell Soc. 15: 51. 1898.

10. **P. occidentale** Scribn. Vernal form yellowish green; culms slender, 6 to 12 inches high, spreading, sparsely pubescent; leaves tending to be clustered toward the base; sheaths sparsely pubescent; ligule ciliate, about 2 lines long; blades glabrous or nearly so above, appressed-pubescent beneath; panicle 2 to 3 inches long, open; spikelets $\frac{7}{8}$ line long, pubescent; autumnal form branching from the lower nodes, forming a spreading tussock; leaves and panicles reduced.

Peat bogs and moist sandy soil, San Diego Co. to British Columbia.

Locs.—Crescent City, *Davy* 5971; Mendocino, *Davy* 6092; New York Falls, *Hansen* 1723; Yosemite Valley, *Brewer* 1646; Merced River, *Torrey* 587; San Diego, *Orcutt* 540.

Refs.—PANICUM OCCIDENTALE Scribn. Rep. Mo. Bot. Gard. 10: 48. 1899. *P. pubescens* [Lam. misapplied by] Presl, Rel. Haenk. 1: 306. 1830.

11. **P. pacificum** Hitchc. & Chase. Vernal form light green, more or less papillose-pilose throughout, 1 to 2 feet high; ligule ciliate, about 2 lines long, spikelets $\frac{7}{8}$ to 1 line long, obtuse, pubescent; autumnal form prostrate-spreading, repeatedly branching from the upper and middle nodes.

Sandy shores and slopes, and moist crevices in rocks. San Bernardino Mts. to British Columbia. The commonest species of the genus in California. Distinguished from P. occidentale by the more copious pubescence throughout, more leafy culms, and, in the autumnal form, by the branching habit.

Locs.—Requa, *Davy & Blasdale* 5894; Redding, *Heller* 7856; Yosemite Valley, *Bolander* 4840, *Hall & Babcock* 3317, 3362; Pinegrove, Amador Co., *Hansen* 626; Pt. Reyes, *Davy* 6745, 6780; San Bernardino Mts., *Parish Bros.* 1663.

Refs.—PANICUM PACIFICUM Hitchc. & Chase, Contr. Nat. Herb. 15: 229. f. 241. 1910, type from Castle Crag, *Hitchcock* 3070. *P. dichotomum* [L. misapplied by] Thurb. in Wats. Bot. Cal. 2: 259. 1880; Davy in Jepson, Fl. W. Mid. Cal. 32. 1901. *P. scoparium* [Lam. misapplied by] Abrams, Fl. Los Ang. 24. 1904. Thurber (l. c.) and Davy (l. c.) also included *P. thermale* and probably other allied species under *P. dichotomum.*

12. **P. thermale** Boland. Vernal form grayish green, densely tufted, velvety-villous, 4 to 12 inches high; culms ascending or spreading; nodes bearded; ligule about $1\frac{1}{2}$ lines long; blades densely velvety-villous on both surfaces; spikelets about 1 line long, pubescent; autumnal form widely spreading, repeatedly branching, forming a dense cushion.

Wet saline soil in vicinity of hot springs, Lassen Peak, *Bolander* 2169; Sonoma Co., *Brewer* 861; common around geysers of Yellowstone Park; also occurring in Alberta and Idaho. Distinguished chiefly by the velvety pubescence and spreading habit.

Refs.—PANICUM THERMALE Boland. Proc. Cal. Acad. 2: 181. 1862, type from Sonoma Co., *Bolander* 3941. Included under *P. dichotomum* by Thurber and by Davy (see above under *P. pacificum*).

13. **P. shastense** Scribn. & Merr. Vernal form 1 to 1½ feet high, papillose-pilose throughout; ligule 1 to 1½ lines long, sparse; spikelets 1¼ lines long, papillose-pubescent; autumnal form spreading, with geniculate nodes and elongated arched internodes, rather sparingly branching from the middle nodes.

Meadows, Castle Crag (the only known locality), *Hitchcock* 3072.

Refs.—PANICUM SHASTENSE Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Circ. 35: 3. 1901, type from Castle Crag, *Greata* in 1899.

14. **P. scribnerianum** Nash. Vernal form erect, 1 to 2 feet high; sheaths papillose-hispid; ligule about ½ line long; blades 2 to 3 inches long, 3 to 6 lines wide, firm, rounded and ciliate at base, glabrous above, often pubescent beneath; panicles 2 to 3 inches long; spikelets slightly over 1½ lines long, turgid, blunt, sparsely hispid or nearly glabrous, strongly nerved; autumnal form branching from the middle and upper nodes, the branches longer than the internodes, late in the season producing crowded branchlets with ascending, not greatly reduced blades and small, partially included panicles from their upper nodes.

Dry prairies from Maine to Maryland west to the Pacific, common in the Mississippi Valley, rare in California. Castle Crag, *Hitchcock* 3074.

Refs.—PANICUM SCRIBNERIANUM Nash, Bull. Torr. Club 22: 421. 1895. *P. scoparium* [Lam. misapplied by] Thurb. in Wats. Bot. Cal. 2: 259. 1880.

8. ECHINOCHLOA Beauv.

Spikelets with 1 perfect flower, nearly sessile in 1-sided spike-like racemes. Glumes unequal, spiny-hispid, mucronate. Sterile lemma similar and awned from the apex, or sometimes mucronate only, inclosing a hyaline palea and sometimes a staminate flower. Fertile lemma and palea chartaceous, acuminate, the margins of the former inrolled except at the summit, the tip of the palea not included. Coarse annuals with compressed sheaths, long leaves and terminal panicles of stout racemes.—Species about 12, in the warm regions of both hemispheres. (Greek echinos, a hedgehog, and chloa, grass.)

Spikelets awned, the texture firm . . . . 1. *E. crusgalli.*
Spikelets awnless, mucronate, the texture rather soft . . . . 2. *E. colona.*

1. **E. crusgalli** Beauv. BARN-YARD GRASS. Culms stout, rather succulent, branching from the base or erect, usually 2 to 3 feet high, sometimes larger; leaves glabrous; panicle dense, 4 to 10 inches long, consisting of several erect or spreading, or even drooping racemes; spikelets green or purple, long-awned or nearly awnless, about 1½ lines long, exclusive of awns, densely and irregularly crowded in 3 or 4 rows.

Fields and cultivated soil, especially along irrigating ditches. Common throughout the U. S. A native of the Old World, some forms apparently native in America.

Refs.—ECHINOCHLOA CRUSGALLI Beauv. Ess. Agrost. 53. 1812. *Panicum crusgalli* L. Sp. Pl. 56. 1753; Thurb. in Wats. Bot. Cal. 2: 260. 1880; Davy in Jepson, Fl. W. Mid. Cal. 31. 1901; Abrams, Fl. Los Ang. 23. 1904.

2. **E. colona** Link. Culms erect, spreading or prostrate, 1 to 2 feet high; leaves smooth; panicle of 5 to 10 dense racemes, ½ to 1 inch long, rather distant, racemose along the axis; spikelets about 1½ lines long; glumes and sterile lemma pubescent, mucronate-pointed, but not awned.

Introduced from the Old World into the warmer parts of America. Reported from San Diego Co. by Thurber, and from Los Angeles and Santa Ana by Abrams.

Refs.—ECHINOCHLOA COLONA Link, Hort. Berol. 2: 209. 1833. *Panicum colonum* L. Syst. Nat. ed. 10. 2: 870. 1759; Thurb. in Wats. Bot. Cal. 2: 260. 1880; Abrams, Fl. Los Ang. 24. 1904.

9. **SETARIA** Beauv. FOXTAIL.

Spikelets as in Panicum but subtended by few or many persistent awn-like branches arising from the rachis below the articulation of the spikelets. Annual introduced weeds, or native perennials, with cylindrical spike-like bristly panicles. (Latin seta, a bristle.)

Perennial; panicle slender. . . . . 3. *S. gracilis.*
Annual; panicle stouter.
  Bristles tawny, 5 or more below each spikelet . . . . 1. *S. glauca.*
  Bristles green or purple, 1 to 3 below each spikelet . . . . 2. *S. viridis.*

1. **S. glauca** Beauv. Annual; culms branching at the base, compressed, erect or ascending, 1 to 2 feet high; blades flat, with a spiral twist; panicle dense, oblong, 1 to 3 inches long; bristles 5 or more, 2 to 4 lines long, tawny-yellow; spikelets 1½ lines long; fruit undulate-rugose.

A native of Europe, commonly introduced into the U. S. A weed in fields and waste places. Rare in California: Riverside, *Wilder* 1043, 1127; Sacramento, acc. Thurber; Fresno, acc. Davy; Los Angeles, acc. Abrams.

Refs.—SETARIA GLAUCA Beauv. Ess. Agrost. 51. 1812; Thurb. in Wats. Bot. Cal. 2: 260. 1880. *Panicum glaucum* L. Sp. Pl. 57. 1753. *Chaetochloa glauca* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 4: 39. 1897; Davy in Jepson, Fl. W. Mid. Cal. 33. 1901; Abrams, Fl. Los Ang. 25. 1904.

2. **S. viridis** Beauv. Annual; culms 1 to 2 feet high; blades flat, not twisted; panicle oblong-ovate, 1 to 2 inches long; bristles 1 to 3, slender, 3 to 6 lines long, green or purple; spikelets 1 line long; fruit faintly wrinkled.

Introduced from Europe; a common weed in the Eastern States, rare in California (Rialto, *Parish* 2112, the only specimen seen).

Refs.—SETARIA VIRIDIS Beauv. Ess. Agrost. 51. 1812. *Panicum viride* L. Syst. Nat. ed. 10. 2: 870. 1759. *Chaetochloa viridis* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 4: 39. 1897.

3. **S. gracilis** H.B.K. Perennial; culms erect, 3 to 4 feet high; blades elongated, narrow, 1 to 2 lines wide, flat or folded; panicle slender, linear, 3 to 4 inches long, about 1½ lines thick; bristles 5 to 8, twice as long as spikelet, pale or tawny; spikelets 1 line long; fruit undulate-rugose.

Fresno, *Griffiths* 4717; Riverside, *Reed* 1186; east to Florida and south into Mexico.

Refs.—SETARIA GRACILIS H. B. K. Nov. Gen. & Sp. 1: 109. 1816. *Chaetochloa gracilis* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. 21: 15. 1900.

S. IMBERBIS Roem. & Schult. (*Chaetochloa imberbis* Scribn.) is reported from Los Angeles, Santa Ana, and San Bernardino by Abrams (Fl. Los Ang. 25. 1904).

PENNISETUM VILLOSUM R. Br. A perennial with culms 1 to 2 feet high, villous below the panicle, and dense soft feathery terminal spikes, 1 to 3 inches long; spikelets surrounded by an involucre of several slender plumose bristles about an inch long, the cluster falling from the axis entire.—A native of Abyssinia, cultivated for ornament and occasionally escaped from gardens. Santa Barbara Co., *Eastwood* in 1908, *Chase* 5600.

LEERSIA ORYZOIDES Swartz, Prodr. 21. 1788; Thurb. in Wats. Bot. Cal. 2: 262. 1880. *Phalaris oryzoides* L. Sp. Pl. 55. 1753. *Homalocenchrus oryzoides* Poll. Hist. Pl. Palat. 1: 52. 1776. Cache Creek, Lake Co., *Bolander* (no. 2418 in the Gray Herbarium), "introduced." San Bernardino, *Parish* in 1885, "probably introduced."

Tribe IV. PHALARIDEAE.

10. PHALARIS L.

Spikelets with 1 perfect flower, laterally flattened. Glumes equal, boat-shaped, exceeding the florets. Sterile lemmas 2, small and narrow, appearing like hairy scales attached to the fertile floret. Fertile lemma indurated and shining in fruit, enclosing a faintly 2-nerved palea. Annuals or perennials, with flat blades and dense spike-like panicles.—Species about 10, mostly natives of southern Europe. (An ancient Greek name for a grass.)

Spikelets in groups of 7, 1 fertile surrounded by 6 sterile . . . . .1. *P. paradoxa.*
Spikelets single, all alike.
  Plants perennial.
    Rhizomes absent; panicle dense, ovate or oblong . . . . .2. *P. californica.*
    Rhizomes present; panicle spreading during anthesis . . . . .3. *P. arundinacea.*
  Plants annual.
    Glumes broadly winged; panicle ovate or short oblong.
      Sterile lemma solitary; fertile lemma 1½ lines long. . . . . .4. *P. minor.*
      Sterile lemmas in pairs; fertile lemma 2 to 3 lines long.
        Sterile lemma ⅓ line long. . . . . .5. *P. brachystachys.*
        Sterile lemma ½ as long as fertile. . . . . .6. *P. canariensis.*
    Glumes wingless or nearly so; panicles oblong or linear, dense.
      Glumes acuminate; fertile lemma turgid, the acuminate apex smooth. . . .7. *P. lemmoni.*
      Glumes acute; fertile lemma less turgid, villous to the acute apex.
        Panicle 1 to 2 inches long; sterile lemmas ⅓ as long as fertile. . . .8. *P. caroliniana.*
        Panicle 2 to 5 inches long; sterile lemma ½ as long as fertile. . . . . . . .9. *P. angusta.*

1. **P. paradoxa** L. Annual; culms cespitose, more or less spreading at base, 1 to 2 feet high; panicle dense, oblong, narrowed at base, 1 to 2 inches long, often enclosed at base in the uppermost enlarged sheath; spikelets finally falling from the axis in groups of 7, the central fertile, nearly sessile, the others sterile, slender-pediceled; glumes of sterile spikelets narrow, with faint lateral nerves, the keel prominently winged above, the wing extending into a more or less well-marked tooth, the apex of the glume narrowed into an acuminate point or awn, the glumes of the 4 outer sterile spikelets in the lower part of the panicle more or less deformed; glumes of fertile central spikelet lanceolate, 3 to 4 lines long including awn, the lateral nerves prominent, the wing on the keel more tooth-like, the apex of the glume narrowed into an awn about 1 line long; fertile lemma smooth and shining, 1½ lines long, the sterile lemmas obsolete.

Occasional in grain fields; a native of the Old World, introduced on the Pacific Coast: Richmond, *Congdon.*

Var. **praemorsa** Coss. & Dur. Sterile spikelets short-pediceled, the 4 outer much reduced, the apex deformed or variously incurved; fertile spikelet somewhat indurated, several-nerved at base, acuminate, the wing fin-like in appearance. Introduced from Europe. Apparently the commoner form in California: Princeton, Berkeley Hills, *Davy;* San Diego, *Brandegee.*

Refs.—Phalaris paradoxa L. Sp. Pl. ed. 2. 2: 1665. 1763; Davy in Jepson, Fl. W. Mid. Cal. 35. 1901, the description applies to the variety. Var. praemorsa Coss. & Dur. Expl. Alg. 2: 24. 1854. *P. praemorsa* Lam. Fl. Franç. 3: 566. 1778.

2. **P. californica** H. & A. Perennial; culms erect or somewhat geniculate at base; blades flat, rather lax, 3 to 6 lines wide; panicle ovoid or oblong, 1 to 2 inches long, ¾ to 1 inch thick, often purplish tinged; glumes about 3 to 3½ lines long, narrow, gradually narrowed from below the middle to an acute apex, smooth or slightly scabrous on the keel, the lateral nerves somewhat

nearer the margin than the keel; fertile lemma ovate lanceolate, about 2 lines long, rather sparsely villous, often exposing the palea, the sterile lemmas about ½ as long.

Ravines and open ground, Coast Ranges from Mendocino Co. to San Luis Obispo Co.

Locs. Mendocino, *McMurphy* 456; Sherwood, *Hitchcock* 2707; Ft. Bragg, *Davy & Blasdale* 6165; San Rafael, *Blankinship* 58; San Francisco, *Bolander* 1529; Los Gatos, *Heller* 8568; Monterey, *Bolander* 665; Pacific Grove, *Heller* 6677; Nipoma, *Brewer* 418.

Refs. PHALARIS CALIFORNICA H. & A. Bot. Beech. 161. 1841, type from San Francisco or Monterey. *P. amethystina* [Trin. misapplied by] Thurb. in Wats. Bot. Cal. 2: 265. 1880; Davy in Jepson, Fl. W. Mid. Cal. 36. 1901. Dr. Stapf, who has examined the type specimen of *P. californica* at Kew, informs me that it is the species that has been called *Phalaris amethystina* by California botanists, but which he considers distinct from that species, the type of which is from Chile. I have examined the type specimen of *P. amethystina* in the Trinius Herbarium and agree with Dr. Stapf that it does not belong to the same species as our California plant. The glumes are shorter and scabrous. (*P. amethystina* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 1: 56. 1835, the type specimen from Leona Rancagua, Chile, *Bertero*, no. 354.)

3. **P. arundinacea** L. Perennial, with creeping rhizomes; culms erect, 2 to 5 feet high; panicle 3 to 7 inches long, narrow, the branches spreading during anthesis, the lower as much as 2 inches long; glumes narrow, 2 lines long, abruptly narrowed to an acute apex, the keel scabrous, not winged, the lateral nerves about midway between margin and keel; fertile lemma lanceolate, 1½ lines long, shining, sparsely villous; sterile lemmas villous, ½ line long.

Swamps and moist places, occasional in northern and central California; common throughout the northern parts of North America, Europe and Asia. A form with variegated leaves is cultivated under the name of Ribbon-grass. Ager, *Brandegee* 25; Warner Mts., *Griffiths & Hunter* 407; Bouldin Island, *Congdon*.

Refs. PHALARIS ARUNDINACEA L. Sp. Pl. 55. 1753; Thurb. in Wats. Bot. Cal. 2: 265. 1880; Davy in Jepson, Fl. W. Mid. Cal. 36. 1901.

4. **P. minor** Retz. Annual; culms erect, 1 to 3 feet high; panicle ovate-oblong to oblong, ½ to 2 inches long; glumes oblong, 2 to 3 lines long, strongly winged on the keel as in P. canariensis, the green stripe less conspicuous, the wing scabrous on margin and more or less toothed; fertile lemma ovate, acute, villous but less so than P. canariensis, about 1½ lines long, the sterile lemma solitary, about ½ line long.

Near the coast from Norman (*Davy* 4265) and Vacaville (*Jepson* 4248) to San Bernardino (*Parish* 4759) and San Diego (*Orcutt* 523). A native of the Mediterranean region, naturalized on the Pacific Coast, occasional in the Eastern States.

Refs. PHALARIS MINOR Retz. Obs. Bot. 3: 8. 1783; Davy in Jepson, Fl. W. Mid. Cal. 34. 1901; Abrams, Fl. Los Ang. 27. 1904.

5. **P. brachystachys** Link. Annual; culms 1 to 2 feet high; panicle ovate, about an inch long; glumes about 3 lines long, similar to those of P. canariensis; fertile lemma 2 to 2½ lines long, densely short villous; sterile lemmas short, brown, ovate, equal, about ⅓ line long.

A native of the Mediterranean region, introduced rarely in America. Nelson, Butte Co., *Heller* 5446, the only specimen seen from California. Differs from P. canariensis chiefly in the short sterile lemmas.

Ref.—PHALARIS BRACHYSTACHYS Link, Neu. Jour. Bot. (Schrad.) 1^2: 134. 1806.

6. **P. canariensis** L. CANARY-GRASS. Annual; culms erect, 1 to 3 feet high; panicle ovate to oblong ovate, ½ to 1½ inches long, pale with green markings;

glumes 3½ to 4 lines long, oblong but widened above, smooth or sparsely villous, the keel prominently winged above, the wing entire or somewhat sinuous, the keel on each side at base of the white wing marked by a green stripe, the lateral nerves approaching the margin; fertile lemma elliptical, acute, densely short-villous, 2½ to 3 lines long; sterile lemmas about ½ as long as fertile.

A native of the Mediterranean region, introduced occasionally in America. Rare in California: Yreka, *Butler* 488; Pasadena, *Grant* 2648.

Refs.—PHALARIS CANARIENSIS L. Sp. Pl. 54. 1753; Thurb. in Wats. Bot. Cal. 2: 264. 1880; Davy in Jepson, Fl. W. Mid. Cal. 34. 1901.

7. **P. lemmoni** Vasey. Annual; culms erect, 1 to 3 feet high; panicle dense, 2 to 4 inches long; glumes about 2½ lines long, narrow, acuminate, the lateral nerves about midway between margin and keel; fertile lemma ovate-lanceolate, acuminate, dark-colored at maturity, villous except the acuminate tip, 1¾ lines long; sterile lemmas less than ⅓ as long.

Central and southern California, mostly near the coast.

Locs.—Nelson, *Heller* 5447; Chinese Camp, *Bioletti* 5; Newark, *Davy* 1093; Oakland, *Bolander* 1530 in part; Saratoga, *Pendleton* 1500; Santa Cruz, *Anderson;* Tulare Lake, *Davy* 3123; Los Angeles, *Grant* 3839; Inglewood, *Abrams* 3234; San Diego, *Baker* 3425; Santa Catalina Island, *Trask.*

Refs.—PHALARIS LEMMONI Vasey, Contr. Nat. Herb. 3: 42. 1892, type from Santa Cruz, *Lemmon* 403; U. S. Dept. Agr. Div. Bot. Bull. 13^1: pl. 5. 1892; Davy in Jepson, Fl. W. Mid. Cal. 35. 1901; Abrams, Fl. Los Ang. 27. 1904.

8. **P. caroliniana** Walt. Annual; culms erect, 1 to 2 feet high; panicle oblong, 1 to 2 inches long; glumes 2½ to 3 lines long, oblong, rather abruptly narrowed to an acute apex, the keel scabrous and narrowly winged above from below the middle, the lateral nerves about midway between keel and margin; fertile lemma ovate, acute, densely villous, about 2 lines long, the close-appressed sterile lemmas about ⅓ as long.

A native of the Southeastern States. Apparently introduced in California where it is rare: Comptche, *McMurphy* 478; Ojai Valley, *Hubby* 39a, 51; San Clemente, Santa Catalina and San Nicholas islands, *Trask.*

Refs.—PHALARIS CAROLINIANA Walt. Fl. Carol. 74. 1788; Davy in Jepson, Fl. W. Mid. Cal. 34. 1901.

9. **P. angusta** Nees. Annual; 3 to 5 feet high, smooth; blades flat, 3 to 4 lines wide; panicle dense, linear-oblong, 2 to 5 inches long, about 4 lines thick; glumes about 2 lines long, narrow, rounded at apex to a mucronate tip, scabrous on keel, nerves, and more or less on the back, especially near the apex, lateral nerves near the margin; fertile lemma ovate-lanceolate, acute, villous, 1½ lines long; sterile lemmas about ½ as long.

California to Louisiana.

Locs.—Oakland, *Bolander* 1530 in part; San Francisco, *Bolander* 2287; Santa Cruz, *Anderson:* Mt. Brewer, *Brewer* 2801; Visalia, *Coville & Funston* 1282; San Luis Obispo, *Lemmon* 4669; San Bernardino, *Parish* 2165, 4729; Fallbrook, *Abrams* 3344.

Refs.—PHALARIS ANGUSTA Nees, Agrost. Bras. 391. 1829. *P. intermedia* Bosc var. *angusta* Chapm. Fl. South. U. S. 568. 1868; Thurb. in Wats. Bot. Cal. 2: 265. 1880.

11. **ANTHOXANTHUM** L.

Spikelets with 1 perfect flower. Glumes unequal. Sterile lemmas 2, 2-lobed, dorsally awned, longer than the fertile floret and falling with it. Fertile lemma truncate, awnless, enclosing a faintly 1-nerved palea. Aromatic grasses with narrow spike-like panicles.—Species 4, European. (Greek anthos, flower, and xanthos, yellow.)

1. **A. odoratum** L. Perennial; culms slender, erect, 8 inches to 2 feet high;

panicle 1½ to 3 inches long, pointed; spikelets brownish green, 4 to 5 lines long; glumes sparsely pilose; first sterile lemma short-awned below the apex, the second bearing a strong bent, scarcely exserted awn near its base.

A native of northern Europe and Asia. Occasionally cultivated in the U. S. as a meadow grass, escaped or introduced in the cooler and moister regions. Crescent City, *Davy & Blasdale* 5954; Humboldt Bay, *Chandler* 1106.

Refs.—ANTHOXANTHUM ODORATUM L. Sp. Pl. 28. 1753; Thurb. in Wats. Bot. Cal. 2: 266. 1880; Davy in Jepson, Fl. W. Mid. Cal. 36. 1901.

12. HIEROCHLOË R. Br.

Spikelets with 1 perfect and 2 staminate flowers. Glumes about as long as spikelet, boat-shaped, shining. Sterile lemmas nearly as long as glumes, boat-shaped, indurated, hairy, often awned, each enclosing a 2-nerved hyaline palea and 3 stamens. Fertile lemma similar but smaller, enclosing a 1-nerved palea and a perfect flower with 2 stamens. Fragrant perennials with flat blades and terminal panicles.—Species about 13, temperate and arctic regions of both hemispheres. (Greek heros, sacred, and chloe, grass.)

1. **H. macrophylla** Thurb. Culms few, erect, 2 to 3 feet high; sheaths scabrous; blades crowded toward base, flat, rather stiffly upright, scabrous above, glaucous beneath, acuminate-pointed, 3 to 7 lines wide; panicle somewhat open, 3 to 5 inches long, the lower branches spreading or drooping, 1 to 2 inches long; glumes 2 lines long.

Redwood belt from Monterey northward into Oregon.

Locs.—Hydesville, *Blankinship* 22; Hubbard Sta., *Davy & Blasdale* 5400; Harris, *Davy & Blasdale* 5361; Duncan's Mills, *Davy* 1637; Marin Co., *Jepson, Davy* 691; San Mateo Co., *Rutter* 306, *Baker* 247; Wrights, *Elmer* 4742; Santa Cruz, *Anderson*; Santa Lucia Mts., *Plaskett* 26.

Refs.—HIEROCHLOË MACROPHYLLA Thurb.; Boland. Trans. Cal. Agr. Soc. 1864-65: 132. 1866, "Redwoods of the Coast Range, especially in Marin County," type *Bolander* 6070; Thurb. in Wats. Bot. Cal. 2: 265. 1880; Davy in Jepson, Fl. W. Mid. Cal. 37. 1901. *Savastana macrophylla* Beal, Grasses N. Am. 2: 187. 1896. *Hierochloë borealis* [Roem. & Schult, misapplied by] Torr. U. S. Rep. Expl. Miss. Pacif. 4: 154. 1857.

TRIBE V. AGROSTIDEAE.

13. ARISTIDA L.

Spikelets 1-flowered, in narrow or open panicles. Glumes narrow, acute, acuminate or short-awned. Lemma with a hard obconical pubescent callus, somewhat indurated, convolute, including the thin palea, terminating in a usually trifid awn. Tufted annuals or perennials with narrow blades.—Species about 100, in the warmer regions of the world. (Latin arista, an awn.)

- Plants annual.
  - Awns about 5 lines long; panicle closely many-flowered........1. *A. bromoides.*
  - Awns 1 to 2 inches long; panicle loosely few-flowered........2. *A. oligantha.*
- Plants perennial.
  - Glumes about equal.
    - Neck of fruit twisted, exserted from glumes........3. *A. palmeri.*
    - Neck of fruit straight, not exserted from glumes.
      - Branches of panicle horizontally spreading........4. *A. divaricata.*
      - Branches of panicle ascending or appressed........5. *A. parishii.*
  - Glumes strongly unequal, the first much shorter than the second.
    - Neck of fruit jointed........6. *A. californica.*
    - Neck of fruit not jointed.
      - Fruit scabrous........7. *A. purpurea.*
      - Fruit smooth.
        - Panicle many-flowered, narrow, strict........8. *A. reverchoni.*
        - Panicle few-flowered, loose........9. *A. fendleriana.*

1. **A bromoides** H.B.K. Annual; culms much branched at the base, 4 to 12 inches long, erect or often spreading or prostrate; blades 1 to 2 inches long, narrow, usually involute; panicle narrow, rather dense, 2 to 3 inches long, the branches short, fascicled; glumes unequal, smooth except the keel of the first, 1 nerved, the first 2½ to 3 lines long, acutish, the second 3½ to 4 lines long, obtuse or slightly mucronate; lemma 4 to 5 lines long, smooth except upper portion of keel, the callus with a dense tuft of short hairs, the apex scarcely narrowed; awns equal, finally spreading, about 5 lines long, or the lateral sometimes shorter.

Open ground, southern California to New Mexico and south through Mexico. Locs. San Luis Obispo, *Jones* 3245; Funeral Mts., *Coville & Funston* 259; The Needles, *Jones* 3788; western edge Colorado Desert, *Hilder* 1080, Colorado River, Riverside Co., *Hall* 5963; Coachella, *Hall* 5797; San Diego, *Brandegee* 832; Santa Catalina Island, *Brandegee*.

Refs. ARISTIDA BROMOIDES H. B. K. Nov. Gen. & Sp. 1: 122. 1816; Thurb. in Wats. Bot. Cal. 2: 289. 1880. *A. americana* L. var. *bromoides* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Circ. 32:5. 1901 (under a misapprehension as to the identity of *A. americana* L., which is *Bouteloua americana* (L.) Scribn. and not *A. dispersa* Trin. & Rupr.); Abrams Fl. Los Ang. 28. 1904.

2. **A. oligantha** Michx. Annual; culms erect, branched at base and all the nodes, 1 to 2 feet high, often woolly at the very base; blades a line wide or less, usually involute, as much as 6 inches long, sparingly pilose at base, the prophyllum often conspicuous at base of branches; panicles narrow, loosely few-flowered, bearing a few scattered large appressed short-pediceled spikelets; glumes about 1 inch long, slightly unequal, long awned from a bifid apex, the first strongly 7-nerved; lemma a little shorter than the glumes, the gradually narrowed neck scaberulous, the callus rather minutely pubescent; awns about equal, widely spreading, 2 to 3 inches long.

A native of the Southeastern States, probably introduced in California. Chico, *Copeland* 3488; Mokelumne region, Sacramento Valley, *Fowler*; Merced Falls, *Kelsey*.

Ref. ARISTIDA OLIGANTHA Michx. Fl. Bor. Am. 1: 41. 1803.

3. **A. palmeri** Vasey. Perennial; culms cespitose, erect, 1 to 2 feet high; blades involute, 2 to 4 inches long, a pilose ring at base extending around the collar; panicle about ½ the entire length of the culm, loose; branches mostly in pairs, stiffly ascending or spreading, spikelet-bearing toward the extremities; glumes acuminate, nearly equal, about 5 lines long, scabrous on the keel and the first also on the obscure lateral pair of nerves; lemma 5 to 6 lines long, smooth except the densely pubescent callus, gradually narrowed above into a twisted neck; awns unequal, the central spreading, about 4 lines long, the lateral erect, 1 to 2 lines long.

San Diego Co. (Hanson's Mt., *Orcutt*); Arizona and northern Mexico.

Refs. ARISTIDA PALMERI Vasey, Bull. Torr. Club 10: 42. 1883. *A. lemmoni* Scribn. in Britt. & Kearn. Trans. N. Y. Acad. Sci. 14: 23. 1894.

4. **A. divaricata** Humb. & Bonpl. Perennial; culms cespitose, erect, 1 to 2 feet high; blades involute, as much as 6 inches long; panicle usually more than ½ the length of the entire plant; branches distant, mostly in pairs, divaricately spreading, spikelet bearing toward the ends; glumes nearly equal, 5 to 6 lines long, 1-nerved, short-awned, the first scabrous on the keel; lemma about 5 lines long, scabrous toward the scarcely narrowed apex; awns about equal, 6 to 10 lines long, somewhat spreading.

Southern California to Texas and south on the Mexican plateau.

Locs.—Bakersfield, *Davy* 1895; Los Angeles, *Hasse*; Pasadena, *Jones* 3216; Pedley Sta., *Reed* 1128; San Jacinto, *Hasse*; San Diego, *Orcutt*.

Ref.—Aristida divaricata Humb. & Bonpl.; Willd. Enum. Pl. 1: 99. 1809.

5. **A. parishii** Hitchc. n. sp. Perennial; culms tufted, 1 to 2 feet high, smooth; sheaths smooth, ciliate at the throat; blades ascending, firm, flat or more or less involute, scabrous on the upper surface, smooth below or scabrous toward the tip, ½ to 1 line wide, 6 to 12 inches long; panicle narrow, about 6 inches long, the branches rather stout, ascending or appressed, the lower 1 to 2 inches long; glumes somewhat unequal, short-awned, smooth or scabrous on the keel, 1-nerved or the first 3-nerved, the second a little longer, 6 lines long; lemma a little shorter than the second glume, very scabrous on the upper half, the neck rather stout, not twisted, the awns ascending, the central about 10 lines long, the lateral a little shorter. (Perennis, caespitosa, 1-2 ped. alta, glabra; vagina ore ciliata; laminae firmae planae vel plus minus involutae, supra scabrae, ½-1 lin. latae, 6-12 poll. longae; panicula angusta, circa 6 poll. longa, ramis ascendentibus; glumae subaequales, breviter aristatae, 1-nerviae vel prima 3-nervia; lemma glumis brevius, parte superiore scaberrimum, aristis ascendentibus, intermedia circa 10 lin. longa, quam ceteris breviore.)

Type in the U. S. National Herbarium, collected by S. B. & W. F. Parish at Agua Caliente, Colorado Desert, Apr., 1882 (no. 1029a). Other specimens referred to this species are: San Diego, *Cleveland*; Cohuila Creek, San Jacinto For. Res., *Leiberg* 3188; Jurupa Hills, *Wilder* 1047½. Differs from A. divaricata chiefly in the shape of the panicle, the branches being short and appressed instead of long and divaricate.

6. **A. californica** Thurb. Perennial; culms cespitose, much-branched at base, 6 inches to 1 foot high; blades short, involute, sharp-pointed, ½ to 1½ inches long; panicles numerous, loose, 1 to 2 inches long, the few branches few-flowered; glumes smooth or the first slightly scabrous near apex, 1-nerved, awnless, unequal, the first 4 lines long, the second about twice as long; lemma 3 lines long, smooth, except the short-pubescent callus, nearly 1 line long, the narrowed apex articulated with the slender, spirally twisted, 9 lines long neck of the awns; awns equal, spreading, about 1 inch long.

Deserts of southern California, Arizona and northern Mexico. The Needles, *Jones* 68a; Borrego Springs, *Brandegee* 106.

Refs.—Aristida californica Thurb.; Boland. Trans. Cal. Agr. Soc. 134. 1864, nomen nudum; Thurb. in Wats. Bot. Cal. 2: 289. 1880, the original specimens cited are: Colorado Desert *(Schott)* and Fort Mohave *(Cooper)*. Var. *fugitiva* Vasey, Contr. Nat. Herb. 3: 49. 1892, type from the Colorado Desert, *Orcutt* 1486. *A.* [illegible] Vasey, l. c. 48, as a synonym under *A. californica*.

7. **A. purpurea** Nutt. Perennial; culms erect, about 2 feet high; blades flat or involute, 2 to 5 inches long; panicles 4 to 6 inches long, rather loose, branches and pedicels slender, more or less recurved; glumes unequal, smooth, short-awned, 1-nerved, the first 3 lines long, the second about twice as long; lemma about 6 lines long, purple, strongly scabrous in lines, the apex somewhat narrowed, flattened and slightly twisted; awns equal, about 1¼ inches long.

Plains and deserts, southern California to Texas and northern Mexico.

Locs.—San Bernardino, *Parish* 2123, 3668; Mentone, *Leiberg* 3295; Jurupa Hills, *Wilder* 1047; The Needles, *Jones* 64a; Riverside, *Reed* 1129; San Jacinto, *Parish Bros.* 1549; Fallbrook, *Parish* 2242.

Refs.—Aristida purpurea Nutt. Trans. Am. Phil. Soc. 5: 145. 1837. *A. aequiramea*

Scheele, Linnaea 22: 343. 1849. *A. filipendula* Buckl. Proc. Acad. Phila. 1862: 93. 1862. *A. purpurea* Nutt. var. *californica* Vasey, Contr. Nat. Herb. 3: 47. 1892, type *Lemmon* 5474, Capay Valley, Yolo Co., but locality out of range and may be an error. *A. fasciculata* Torr. var. *californica* Vasey; Beal, Grasses N. Am. 2: 207. 1896. *A. purpurea* Nutt. var. *aequiramea* Merr. U. S. Dept. Agr. Div. Agrost. Circ. 34: 7. 1901; Abrams, Fl. Los Ang. 29. 1904.

8. **A. reverchoni** Vasey. Perennial; culms densely cespitose, erect, 1 to 2 feet high; blades involute, more or less flexuous, as much as 6 inches long; panicle narrow, 4 to 6 inches long; branches short, appressed; glumes unequal, awnless, smooth, or the first scabrous on the upper part of keel, the first about 3 lines long, the second about 5 lines long; lemma 5 to 6 lines long, smooth except the minutely pubescent callus, narrowed above but not twisted; awns equal, about 10 lines long.

Deserts and plains, southern California (Newberry, *Chase* 5788) to Texas.

Ref.—ARISTIDA REVERCHONI Vasey, Bull. Torr. Club 13: 52. 1886.

9. **A. fendleriana** Steud. Perennial; culms densely cespitose, erect, usually less than 1 foot high, blades crowded at base of culms forming a curly tuft, involute, arcuate, sharp-pointed, pilose at base, usually 1 to 2 inches long, but sometimes longer; panicle narrow, 2 to 4 inches long, bearing a few, mostly short-pediceled, loosely arranged, more or less appressed spikelets; glumes unequal, smooth, awnless, 1-nerved, the first about 3 lines long, the second 5 to 6 lines long; lemma 4 lines long, scaberulous and slightly narrowed above; callus minutely pubescent, ½ line long; awns equal, about 1 inch long, ascending.

Deserts and plains, southern California to Texas. San Bernardino Mts., *Parish* 3299, 3828.

Refs.—ARISTIDA FENDLERIANA Steud. Syn. Pl. Glum. 1: 420. 1854. *A. purpurea* Nutt. var. *fendleriana* Vasey, Contr. Nat. Herb. 3: 46. 1892. *A. fasciculata* Torr. var. *fendleriana* Scribn. in Britt. & Kearn. Trans. N. Y. Acad. Sci. 14: 23. 1894. *A. longiseta* Steud. var. *fendleriana* Merr. U. S. Dept. Agr. Div. Agrost. Circ. 34: 5. 1901.

14. STIPA L.

Spikelets 1-flowered, in terminal, open or narrow panicles. Glumes narrow, acute or bristle-tipped. Lemma with a bearded sharp-pointed callus, pubescent, indurated, convolute, including the small palea, terminating in a simple, usually stout geniculate twisted awn. Rather coarse tufted perennials with narrow or involute blades.—Species about 100, throughout the tropical and temperate regions of the world, especially on plains and deserts. (Greek stupa, tow, referring to the feathery awns of some of the species.)

Awn above second bend about 3½ inches long, flexuous..........1. *S. comata.*
Awn above second bend not over 1½ inches long, usually much shorter.
  Awn plumose.
    Awn with one bend, very plumose below bend..........2. *S. speciosa.*
    Awn with two bends, plumose to second bend.
      Ligule 1½ to 3 lines long..........3. *S. thurberiana.*
      Ligule very short.
        Sheaths glabrous..........4. *S. occidentalis.*
        Sheaths pubescent..........5. *S. elmeri.*
  Awn only scabrous or puberulent.
    Lemma clothed with copious long hairs 2 lines long.
      Awn with two bends; plants 3 feet or more high..........6. *S. coronata.*
      Awn usually with one bend; plants 1 to 1½ feet high..........7. *S. parishii.*
    Lemma more or less hairy, the hairs not over ½ line long.
      Panicles loose, the branches spreading.
        Terminal segment of awn about 1½ inches long..........8. *S. setigera.*
        Terminal segment of awn about ¾ inch long..........9. *S. eminens.*

Panicles narrow, the branches erect.
  Sheaths hairy at the throat.
    Glumes 7 to 8 lines long.......................................10. *S. stillmanii.*
    Glumes 5 lines long or less.
      Glumes thin and papery, obscurely nerved; panicle slender...11. *S. californica.*
      Glumes firm, the first plainly 5 to 7-nerved; panicle rather stout...12. *S. vaseyi.*
  Sheaths not hairy at the throat.
    Glumes 6 lines long, broad.......................................13. *S. lemmoni.*
    Glumes 3 to 4 lines long.
      Leaves mostly basal; blades capillary-involute................14. *S. lettermani.*
      Leaves scattered; blades flat or involute; culms stouter.........15. *S. minor.*

1. **S. comata** Trin. & Rupr. Culms 2 to 4 feet high, smooth; sheaths smooth; ligule 2 to 3 lines long; blades becoming involute, elongated; panicle loose, open, 6 to 10 inches long; branches slender, ascending, or, in anthesis, spreading, the lower 3 to 4 inches long, bearing usually 2 spikelets toward the extremities; glumes nearly an inch long, gradually narrowed into an awn, smooth, 5-nerved, thin, papery; lemma 5 to 6 lines long, rather sparsely appressed-villous; callus 1½ lines long; awn very long, the first section ¾ to 1½ inches long, closely twisted, appressed-villous but becoming nearly smooth, the second like the first but shorter, the third section, as long or longer than the other two, more or less flexuous but not twisted, scabrous, very slender.

From Lake Tahoe (*Hitchcock* 3125) to Argus Mts. (*Purpus* 5461); British Columbia to Mexico, east to Great Plains.

Refs.—STIPA COMATA Trin. & Rupr. Mém. Acad. St. Pétersb. VI. Sci. Nat. 5^1: 75. 1842; Thurb. in Wats. Bot. Cal. 2: 285. 1880.

2. **S. speciosa** Trin. & Rupr. Culms numerous, cespitose, 1 to 2 feet high; sheaths smooth, or lower pubescent or even felty at the very base, the throat densely short-villous; ligule short; blades elongated, involute-filiform, mostly basal, more or less deciduous from the outer and older persistent sheaths; panicle narrow, dense, 4 to 6 inches long, not much exceeding the leaves, white or tawny, feathery from the plumose awns; glumes smooth, 7 to 8 lines long, 3-nerved, long-acuminate, papery; lemma 3½ to 4½ lines long, narrow, densely short-pubescent, the callus sharp and smooth below; awn with one sharp bend, the first section ½ to ¾ inch long, densely long-pilose on the lower ½ or ⅔, the hairs 3 to 4 lines long, the remaining portion of the awn scabrous, the second section about 1 inch long.

Central California to Colorado, south into Mexico; also Chile, the type locality. Especially characteristic of the Colorado and Mohave deserts and the deserts north to Mono Lake (*Bolander* 6117); also occurs at Adobe Valley, Stanislaus Co., *Elmer* 4349, and San Luis Obispo, *Lemmon* 5470.

Refs.—STIPA SPECIOSA Trin. & Rupr. Mém. Acad. St. Pétersb. VI. Sci. Nat. 5^1: 45. 1842; Thurb. in Wats. Bot. Cal. 2: 284. 1880; Abrams, Fl. Los Ang. 31. 1904. *S. chrysophylla* Desv. in Gay, Fl. Chil. 6: 278. pl. 76. f. 2. 1853; Thurb. in Wats. Bot. Cal. 2: 285. 1880.

3. **S. thurberiana** Piper. Culms 6 inches to 1½ feet high; sheaths smooth or somewhat scabrous, mostly basal; ligule long, about 1½ to 2 lines long, acute; blades involute, scabrous; panicle 2 to 4 inches long, often subtended by an enlarged sheath; glumes about 6 lines long, acuminate, 3-nerved; lemma 3½ lines long, appressed-pilose, the callus acute; awn about 1½ inches long, indistinctly twice-geniculate, short-pilose to the second bend.

In the mountains, central California to Washington.

Locs.—Yreka, *Butler* 1271; Modoc Nat. For., *Hatton*; Sierra Nevada, *Lemmon*; S. Cal., *G. R. Vasey* in 1880.

Refs. STIPA THURBERIANA Piper, U. S. Dept. Agr. Div. Agrost. Circ. 27: 10. 1900. *S. occidentalis* [Thurb. misapplied in] Wilkes, U. S. Expl. Exped. 17: 483. 1874; Thurb. in Wats. Bot. Cal. 2: 285. 1880.

4. **S. occidentalis** Thurb. Culms slender, cespitose, 1 to 2 feet high; sheaths smooth; ligule ½ line long; blades narrow, involute; panicle narrow, 4 to 8 inches long; glumes 4 to 5 lines long, acuminate, 3-nerved, smooth; lemma 3 lines long, long pilose, the callus sharp, awn about 1 inch long, twice-geniculate, pilose to the second bend or throughout, the first section 3 to 4 lines long.

Sierra Nevada, from Mt. Shasta (*Hitchcock* 2938), southward, also in southern Coast Ranges (Mt. Wilson, *Abrams* 2598); north to Washington and east to Wyoming.

Refs. STIPA OCCIDENTALIS Thurb.; Wats. U. S. Geol. Explor. 40th Par. 5: 380. 1871. *S. stricta* Vasey, Bull. Torr. Club 10: 42. 1883. Var. *sparsiflora* Vasey, Contr. Nat. Herb. 3: 51. 1892, type *Bolander* 5038 (from Yosemite Park). *S. occidentalis* Thurb. var. *montana* Merr. & Davy, Univ. Cal. Publ. Bot. 1: 62. 1902, type *Bolander* 5038. *S. oregonensis* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 17: 130. f. 426. 1899.

5. **S. elmeri** Piper & Brodie. Culms 2 to 3 feet high, more or less puberulent, especially at the nodes; sheaths pubescent; ligule very short; blades flat or becoming involute, pubescent on the upper surface, or those of the innovations also on the lower surface; panicle narrow, 6 to 15 inches long, rather loose; glumes 3-nerved, gradually acuminate, thin, papery, 6 to 7 lines long, the first a little the longer; lemma about 3½ lines long, appressed-pubescent, the callus ½ line long, glabrous at the point; awn distinctly twice-geniculate, first section 4 to 5 lines long, second section somewhat shorter, both plumose, third section about 8 to 10 lines long, scabrous.

In the mountains, southern California to Washington.

Locs. Shasta Nat. For., *Sampson* 171; Upton, *Congdon*; Long Valley, Lassen Co., *Davy*; Yosemite Nat. Park, *Hitchcock* 3247, 3336; Mt. Tallac, *Hitchcock* 3124; Mill Creek Falls, San Bernardino Co., *Parish* 2491; San Jacinto Mts., *Hall* 2537.

Refs. STIPA ELMERI Piper & Brodie, U. S. Dept. Agr. Div. Agrost. Bull. 11: 46. 1898. *S. viridula* Trin. var. *pubescens* Vasey, Contr. Nat. Herb. 3: 50. 1892.

6. **S. coronata** Thurb. Culms stout, 4 to 6 feet high, as much as ¼ inch thick at base, smooth or pubescent below the nodes; sheaths smooth, the margin and throat villous; ligule about 1 line long, ciliate margined; blades very long, flat, with a slender involute point; panicle narrow, dense, stout, purplish, 1 to 1½ feet long; glumes gradually acuminate, 3-nerved, smooth except the scabrous keel of the first, unequal, the first about 10 lines long, the second 1 to 2 lines shorter; lemma about 4 lines long, densely villous with long appressed hairs; awn twice-geniculate, first section about 5 lines long, twisted, scabrous but not villous, second section similar but shorter, third section about as long as the other two, straight.

Coast Ranges, Monterey Co. southward, extending into Lower California.

Locs. Cone Peak, Monterey Co., *Davy* 7716; Pico Blanco, *Davy* 7345; Tassajara Hot Springs, *Elmer* 3302; San Bernardino Co., *Parish* 3665; Los Angeles Co., *Abrams* 623, 1305, *Leiberg* 3336; Riverside Co., *Baker* 5282, *Hall* 2078; San Diego Co., *Abrams* 3360, *Orcutt* 1068.

Refs.—STIPA CORONATA Thurb. in Wats. Bot. Cal. 2: 287. 1880; Abrams, Fl. Los Ang. 30. 1904.

7. **S. parishii** Vasey. Culms stout, 1 to 2 feet high; sheaths smooth, villous at the throat; ligule short, ciliate; blades firm, flat, with a slender involute point, very scabrous above, about 2 lines wide; panicle 6 to 8 inches long, narrow, dense, purple tinged; glumes smooth, 3-nerved, long-acuminate, unequal, the first 7 lines long, the second a line shorter; lemma 3½ lines long,

densely long-villous, especially above; awn about an inch long, once-geniculate, twisted below, straight above, nearly smooth.

Southern California and western Nevada.

Locs.—San Bernardino Mts., *Hall* 7580, *Parish Bros.* 1079, 1079a, *Parish* 2487, 3287, *Wilder* 1127; San Jacinto Mts., *Hall* 2309; Jamacha Hot Springs, *Abrams* 3637.

Refs.—STIPA PARISHII Vasey, Bot. Gaz. 7: 33. 1882, type *Parish Bros.* 1079; Abrams, Fl. Los Ang. 30. 1904.

8. **S. setigera** Presl. Culms 2 to 3 feet high; blades long and narrow, flat or involute; ligule about ½ line long; panicle about 6 inches long, loose, the branches spreading, slender, some of the lower 1 to 2 inches long; glumes narrow, long-acuminate, purplish, 3-nerved, unequal, the first about 10 lines long, the second 1 or 2 lines shorter; lemma 4 lines long, sparingly pilose, the callus sharp; awn 2 to 3 inches long, short-pubescent to the second bend, the first section ½ to ¾ inch long, the second shorter, the third slender and flexuous.

Mostly in the Coast Ranges, Walker Valley (*Davy & Blasdale* 5041) to San Diego (*Baker* 833) and Santa Barbara Islands (*Trask*), eastward to Susanville (*Brandegee*), Amador Co. (*Hansen* 1668), Northfork (*Griffiths* 4601), and Winchester (*Hall* 2921); east to Texas and south into Mexico. Historic specimens referred here are: *Bolander* 4802, *Bigelow* (Whipple Expl.), *Brewer* 1262, *Hartweg* 2028, *Kellogg & Harford* 1096, *Lemmon* 5452, 5455, 5472, *Parish Bros.* 1550, 1554, *Parish* 2038, *Torrey* 759.

Refs.—STIPA SETIGERA Presl, Rel. Haenk. 1: 226. 1830; Thurb. in Wats. Bot. Cal. 2: 286. 1880; Davy in Jepson, Fl. W. Mid. Cal. 38. 1901; Abrams, Fl. Los Ang. 31. 1904. *S. neesiana* [Trin. & Rupr. misapplied by] Torr. U. S. Rep. Expl. Miss. Pacif. 4: 154. 1857.

9. **S. eminens** Cav. Culms slender, puberulent below the nodes, 2 to 3 feet high; sheaths smooth, sparingly villous at throat; ligule very short; blades flat, narrow, 1 to 2 lines wide, pubescent on upper surface near base; panicle rather loose and open, usually 6 to 8 inches long, but sometimes more than 1 foot long, the branches distant, slender; glumes 3-nerved, smooth, unequal, acuminate, the first 3 to 5 lines long, the second about 1 line shorter; lemma about 3 lines long, sparingly villous, nearly glabrous toward the hairy tufted apex; awn indistinctly twice geniculate, about 1 to 1½ inches long, scabrous but not villous.

Coast Ranges from Berkeley Hills (*Davy* 1235) to San Diego (*Orcutt* 1065), east to San Bernardino (*Parish* 2055); south into Lower California and east to Texas and Mexico.

Var. **andersoni** Vasey. Differs from S. eminens chiefly in the slender involute blades. This form is, on the average, a smaller plant, the culms being shorter, the panicles narrower and few-flowered, the spikelets usually smaller.—Confined to California, where the range is about the same as that of S. eminens but extending north to Mt. Shasta (*Jepson* in 1895).

Refs.—STIPA EMINENS Cav. Icon. Pl. 5: 42. pl. 467. f. 1. 1799; Thurb. in Wats. Bot. Cal. 2: 286. 1880; Abrams, Fl. Los Ang. 30. 1904. Var. ANDERSONI Vasey, Contr. Nat. Herb. 3: 54. 1892, type from Santa Cruz, *Anderson*, according to the label on the type specimen in the National Herbarium (the type locality, "Lower California", as published, evidently an error); Davy in Jepson, Fl. W. Mid. Cal. 38. 1901. *S. hassei* Vasey, Contr. Nat. Herb. 1: 267. 1893, type from Santa Monica, *Hasse*, a specimen deformed by smut; Abrams, Fl. Los Ang. 29. 1904.

S. PRINGLEI Scribn. Culms 2 to 3 feet high; blades flat, firm, smooth, coarsely nerved; ligule 1 line long; panicle open, the branches few-flowered; glumes 5 lines long; lemma nearly as long as glumes, sparingly pilose; awn about ¾ inch long, twice geniculate, incurved, nearly smooth. There are two specimens of this species collected by Lemmon, one in 1882, marked "California," the other in 1884, no. 394, the locality not given. It is doubtful, however, if this species occurs in California. These specimens are probably from Arizona.

10. **S. stillmanii** Boland. Culms stout, 2 to 3 feet high; sheaths smooth, puberulent at the throat and collar; ligule very short; blades scattered, folded or involute, firm, the uppermost filiform; panicle narrow, dense or interrupted at base, the branches short, fascicled; glumes equal, papery, minutely scabrous, acuminate into a scabrous awn-point, 7 to 8 lines long, the first 3-nerved, the second 5-nerved; lemma 4½ lines long, short-pilose, the callus short; awn about 1 inch long, once or indistinctly twice-geniculate, scabrous.

Only known from the collection of Bolander, from Blue Cañon, Placer Co. (the type). Three other sheets in the National Herbarium, presumably of the same collection, are labeled from the Sierra Nevada, altitude 4000 feet.

Refs.—STIPA STILLMANII Boland. Proc. Cal. Acad. 4: 169. 1873; Thurb. in Wats. Bot. Cal. 2: 287. 1880.

11. **S. californica** Merr. & Davy. Culms 2 to 5 feet high, smooth, or the nodes pubescent; sheaths smooth, villous at the throat; ligule very short; blades flat, becoming involute, especially at the long slender point; panicle narrow, usually 1 to 1½ feet long; branches fascicled, short, appressed, or some of the lower as much as 5 inches long; glumes thin and papery, equal, about 5 lines long, smooth, 3-nerved, the lateral nerves rather indistinct; lemma about 3 lines long, appressed-villous; awn twice-geniculate, the first section 3 to 5 lines long, closely twisted, villous, the second section shorter, 2 to 3 lines long, twisted, villous, the third section 5 to 8 lines long, straight, scabrous only and lighter in color.

Sierra Nevada from Mt. Shasta to Yosemite, and in the San Jacinto Mts.

Locs.—Mt. Shasta, *Hitchcock* 2948; Castle Crag, *Hitchcock* 3064; Shasta Retreat, *Heller* 7936; Donner Lake, *Torrey* 578; Mt. Tallac, *Hitchcock* 3121, 3159; Yosemite Nat. Park, *Bolander* 6109, *Hall & Babcock* 3336.

Refs.—STIPA CALIFORNICA Merr. & Davy, Univ. Cal. Publ. Bot. 1: 61. 1902, type from the San Jacinto Mts., *Hall* 2556. This appears to be the species described under *S. viridula* Trin. by Davy in Jepson, Fl. W. Mid. Cal. 39. 1901, and Abrams, Fl. Los Ang. 31. 1904.

12. **S. vaseyi** Scribn. Culms 2 to 3 feet high; sheaths somewhat hairy at the throat; blades elongated, involute; panicle about 1 foot long, dense, the branches and branchlets numerous, many-flowered; glumes narrow, acuminate, scabrous, the first a little longer, rather strongly 5 to 7-nerved, 5 lines long; lemma about 3 lines long, appressed-pilose, the callus short, pilose; awn twice-geniculate, about 1 inch long, minutely puberulent.

Texas to Colorado and Arizona, south into Mexico. There is but one specimen of this from California (San Nicholas Island, *Trask*), consisting of a panicle and one leaf, which differs from the type from Texas, in having a longer awn and a more distinctly nerved glume.

Refs.—STIPA VASEYI Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 46. 1898. *S. viridula* Trin. var. *robusta* Vasey, Contr. Nat. Herb. 3: 50. 1892.

13. **S. lemmoni** Scribn. Culms 2 to 3 feet high, sometimes pubescent below the nodes; sheaths smooth; ligule about ½ line long; blades usually flat, pubescent on upper surface; panicle narrow, the branches 1 to 2 inches long, appressed; glumes nearly equal, rather broad, scarious, acuminate, 3 to 5-nerved, 6 lines long; lemma 3½ lines long, rather thinly appressed-pilose, the callus short; awn about 1 inch long, twice-geniculate, appressed-pilose to the second bend.

In the Sierra Nevada (Moffat Creek, Siskiyou Co., *Butler* 830) to Tehachapi (*Chase* 5731) and in the Coast Ranges (Red Mt., Humboldt Co., *Bolander* 6469) to Mendocino Co. (*Davy & Blasdale* 5287); north to Washington.

Var. **jonesii** Scribn. Differs in the more slender firm involute blades, and smaller spikelets; glumes about 4 lines long; lemma about 3 lines long, the awn ¾ inch long, tending to be incurved, the pubescence shorter.—Washington and Idaho to California. Yreka, *Butler* 810; Sierra Nevada as far south as Mariposa Co. (*Bolander* 4865); also in the mountains of San Diego Co. (*Brandegee* 129).

Refs.—STIPA LEMMONI Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 30: 3. 1901. *S. pringlei* Scribn. var. *lemmoni* Vasey, Contr. Nat. Herb. 3: 541. 1892, type from Plumas Co., *Lemmon* 5456. Var. JONESII Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 30: 4. 1901, type from Emigrant Gap, *Jones* 3298.

14. **S. lettermani** Vasey. Culms cespitose, slender, 1 to 1½ feet high; sheaths smooth; ligule very short; blades crowded at base of plant, short, slender, involute; panicle narrow, 3 to 8 inches long; glumes narrow, acuminate, 3-nerved, about 4 lines long; lemma narrow, 2½ lines long, pilose; awn very slender, about ½ inch long, nearly smooth, twice-geniculate, the first section short, about 1½ lines long.

California to Idaho and Colorado.

Locs.—Lincoln Valley, Sierra Co., *Kennedy & Doten* 215; Truckee, *Hitchcock;* San Bernardino Mts., *Parish Bros.* 1552.

Refs.—STIPA LETTERMANI Vasey, Bull. Torr. Club 13: 53. 1886. *S. viridula* Trin. var. *lettermani* Vasey, Contr. Nat. Herb. 3: 50. 1892.

15. **S. minor** Scribn. Culms few in a cluster, 2 to 3 feet high; sheaths smooth; ligule very short; blades flat or becoming involute, narrow, as much as 1 foot long; panicle narrow, 6 to 8 inches long; glumes 3 lines long, 3-nerved, slightly scabrous on the keels; lemma narrow, pilose, 2½ lines long; awn about ½ inch long, nearly smooth, twice-geniculate, the first section 1½ lines long.

High Sierra Nevada of central California; probably also in Mexico. Differs from S. lettermani only in being larger, the blades more scattered, flat or tardily involute, and the panicles longer.

Locs.—Summit Valley, *Pringle;* Yosemite Nat. Park, *Bolander* 5078, *Hitchcock* 3304, 3324; Farewell Gap, *Hitchcock* 3393.

Refs.—STIPA MINOR Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 46. 1898. *S. viridula* Trin. var. *minor* Vasey, Contr. Nat. Herb. 3: 50. 1892. *S. viridula* as described by Thurb. in Wats. Bot. Cal. 2: 288. 1880, appears to include *S. minor*, *S. lettermani*, *S. californica* and *S. lemmoni.*

15. **ORYZOPSIS** Michx.

Spikelets 1-flowered, in narrow or open panicles. Glumes rather broad, obtuse or abruptly acute. Lemma with a short obtuse callus, convolute, somewhat indurated, including the rather large palea, terminating in a simple slender, usually short, deciduous awn. Perennials.—Species about 15 in temperate regions of the northern hemisphere. (Greek orusa, rice, and opsis, appearance.)

Lemma smooth; spikelets numerous, 1½ lines long; blades flat..............1. *O. miliacea.*
Lemma pilose; blades involute.
  Branches of panicle and capillary pedicels divaricately spreading..........2. *O. hymenoides.*
  Branches of panicle and pedicels erect or ascending.
    Glumes about 2 lines long; lemma sparingly pilose........................3. *O. kingii.*
    Glumes 4 to 5 lines long; lemma densely long-pilose.
      Awn 3 lines long; culms 6 inches to 1 foot high........................4. *O. webberi.*
      Awn 6 lines long; culms 1 to 2 feet high..............................5. *O. bloomeri.*

1. **O. miliacea** Benth. & Hook. Culms erect from a decumbent base, 2 to 3 feet high; sheaths smooth; ligule about 1 line long; blades flat, 4 to 5 lines wide; panicle as much as a foot long, loose, the branches spreading; glumes 1½ lines long, smooth, equal; lemma smooth, 1 line long, the deciduous straight awn about 2 lines long.

A native of Europe, introduced in a few localities in California. Cahto, Mendocino Co., *Davy* 6624; Santa Barbara, *Grant* 5388; Los Angeles, *McClatchie* 1222.

Refs.—ORYZOPSIS MILIACEA Benth. & Hook.; Aschers. & Schweinf. Mém. Inst. Égypte 2: 169. 1887. *Agrostis miliacea* L. Sp. Pl. 61. 1753.

2. **O. hymenoides** Ricker. Culms cespitose, 1 to 2 feet high; sheaths smooth or minutely scabrous; ligule about 3 lines long, acute; blades slender, elongated, nearly as long as the culms; panicle diffuse, 3 to 6 inches long, the slender branches in pairs, the branchlets dichotomous, all divaricately spreading, the ultimate pedicels capillary, flexuous, enlarged below the spikelets; glumes equal, about 3 lines long, puberulent, papery, ovate, 3-nerved, abruptly narrowed into an awn-like point; lemma fusiform, turgid, about 1½ lines long, nearly black at maturity, densely long-pilose with hairs 1½ lines long; awn when present about 2 lines long, straight, readily deciduous.

Deserts and plains of the southern portion of the state, rare northward to Mt. Shasta (*Hall & Babcock* 4093); Washington to Manitoba, south to Mexico.

Refs.—ORYZOPSIS HYMENOIDES Ricker; Piper, Contr. Nat. Herb. 11: 109. 1906. *Stipa hymenoides* Roem. & Schult. Syst. Veg. 2: 239. 1817. *Eriocoma cuspidata* Nutt. Gen. 1: 40. 1818; Thurb. in Wats. Bot. Cal. 2: 283. 1880.

3. **O. kingii** Beal. Culms tufted, slender, 8 to 15 inches high; blades numerous at the base of the plant, involute, capillary; ligule about ½ line long; panicle narrow, loose, the short slender branches appressed or ascending, few-flowered; glumes broad, papery, nerveless, obtuse, purple at base, unequal, the first about 1¾ lines long, the second a little longer; lemma elliptical, 1½ lines long, rather sparingly appressed-pubescent, the callus short; awn more or less sickle-shaped, bent in a wide curve or indistinctly geniculate below the middle, not twisted, minutely pubescent, not readily deciduous, about ½ inch long.

Only known from the high central Sierra Nevada.

Locs.—Upper Tuolumne, *Bolander* 6097; Lyell Fork Cañon, *Hitchcock* 3289; Clouds Rest, *Congdon*; Black Mt., Fresno Co., *Hall & Chandler* 601.

Refs.—ORYZOPSIS KINGII Beal, Grasses N. Am. 2: 229. 1896. *Stipa kingii* Boland. Proc. Cal. Acad. 4: 170. 1872, type from Mt. Dana, *Bolander* 6097 (the number given with the original description is 6076, but all the original specimens distributed under *Stipa kingii* are numbered 6097, and this is the number found in Bolander's Field Book for the Mt. Dana collection of *Stipa kingii*); Thurb. in Wats. Bot. Cal. 2: 287. 1880.

4. **O. webberi** Benth. Culms cespitose, erect, 6 inches to 1 foot high; blades involute, filiform, scabrous; panicle narrow, 1 to 2 inches long, the branches appressed; glumes equal, narrow, obscurely 5-nerved, minutely scaberulous, acuminate, about 4 lines long; lemma narrow, 3 lines long, densely long-pilose, the awn about 3 lines long, straight or bent, not twisted.

Deserts and plains; Lassen Co. (Smoke Creek, *Griffiths & Hunter* 485) to Colorado.

Refs.—ORYZOPSIS WEBBERI Benth.; Vasey, Grasses U. S. 23. 1883. *Eriocoma webberi* Thurb. in Wats. Bot. Cal. 2: 283. 1880, type from Sierra Valley, *Bolander*.

5. **O. bloomeri** Ricker. Culms tufted, 1 to 2 feet high, glabrous; sheaths glabrous; ligule about ½ line long; blades crowded at the base, involute, nar-

row, firm; panicle 3 to 6 inches long, the branches slender, rather stiffly ascending, the longer 2 to 3 inches long, bearing spikelets from about the middle; glumes comparatively broad, indistinctly 3 to 5-nerved, smooth, rather abruptly acuminate, equal, 4 to 5 lines long; lemma elliptical, 2½ lines long, densely long-villous; awn about ½ inch long, tardily deciduous, once-geniculate, the first section about 3 lines long, slightly twisted, appressed-villous, indistinctly bent or flexuous, the second section straight, minutely scabrous.

Dry regions, Washington to Manitoba and south to New Mexico.

Locs.—Moulton, Modoc Co., *Griffiths & Hunter* 456; Mt. Diablo, *Bolander*; Lancaster, *Elmer* 4165.

Refs.—ORYZOPSIS BLOOMERI Ricker; Piper, Contr. Nat. Herb. 11: 109. 1906. *Stipa bloomeri* Boland. Proc. Cal. Acad. 4: 168. 1872, type from Mono Pass, *Bolander* 6116. *S. sibirica* [Lam. misapplied by] Thurb. in Wats. Bot. Cal. 2: 287. 1880.

16. MUHLENBERGIA Schreb.

Spikelets 1-flowered. Glumes thin, 1-nerved, often aristate. Lemma with a short, often barbate callus, narrow, membranaceous, 3-nerved, acute, mucronate, or often awned from the tip or from between the teeth of the bidentate apex. Palea thin, about as long as lemma. Annual or usually perennial grasses, the inflorescence varying from an open and diffuse, to a narrow and spike-like panicle.—Species about 60, mostly American, especially abundant on the Mexican plateau. (Rev. Dr. Henry Muhlenberg, a distinguished American botanist, 1753—1815.)

Hairs at base of floret at least half as long as body of lemma; panicle narrow; perennials.

  Hairs at base of floret copious, as long as body of lemma...............1. *M. comata.*

  Hairs at base of floret not over ½ as long as body of lemma.

    Panicle loose; upper glume 3-toothed; blades involute...............2. *M. gracilis.*

    Panicle close; glumes entire; blades flat.

      Blades narrow, about 1 line wide...............3. *M. lemmoni.*

      Blades broad, 1½ to 2½ lines wide...............4. *M. californica.*

Hairs at base of floret minute or wanting.

  Glumes erose-toothed; culms erect; plants perennial, without rhizomes......7. *M. jonesii.*

  Glumes entire; culms mostly decumbent or spreading; plants perennial with rhizomes, or annual.

    Lemma awned, the awn 3 lines long or more.

      Plants annual; panicle narrow; awn 5 to 7 lines long...............5. *M. microsperma.*

      Plants perennial; panicle diffusely spreading; awn 3 lines long.........6. *M. porteri.*

    Lemma unawned, mucronate; panicles narrow.

      Culms capillary; plants lax and soft, no creeping rootstocks, often annual; blades flat...............8. *M. filiformis.*

      Culms stouter, rather woody or wiry, rootstocks creeping; blades involute.

        Plants widely spreading or creeping; glumes ¾ line long.............9. *M. repens.*

        Plants erect or decumbent at base; glumes ½ line long............10. *M. squarrosa.*

1. **M. comata** Thurb. Perennial, with numerous scaly rhizomes; culms erect or sometimes spreading, smooth below, scabrous above, pubescent about the nodes, 1½ to 3 feet high; sheaths smooth or slightly scabrous, keeled; ligule ½ line long, membranaceous, short-ciliate; blades flat, 1 to 3 lines wide, scabrous; panicles narrow, spike-like, usually more or less lobed or interrupted, often purple-tinged, 3 to 6 inches long; glumes narrow, acuminate, 1-nerved, smooth, ciliate-scabrous on the keels, 1½ to 2 lines long; lemma 1½ lines long, gradually narrowed into a capillary awn 2 to 4 lines long, the hairs at base of floret copious, 1 to 1½ lines long.

Mt. Shasta south through the Sierra Nevada to the San Bernardino Mts. In the mountains from Washington to Wyoming and south to Colorado.

Locs.—Mt. Shasta, *Pringle;* Castle Crag, *Hitchcock* 3078; Sierra Valley, *Lemmon* 5475; Mono Lake, *Bolander* 6094; Yosemite Nat. Park, *Bolander* 6094a, 6101, *Hitchcock* 3213; Mt. Dana, *Bolander;* Sequoia Nat. Park, *Hitchcock* 3376, 3377; San Bernardino Mts., *Abrams* 2906.

Refs.—MUHLENBERGIA COMATA Thurb.; Benth. in Jour. Linn. Soc. Bot. 19: 83. 1881. *Vaseya comata* Thurb. in Gray, Proc. Acad. Phila. 1863: 79. 1863; Thurb. in Wats. Bot. Cal. 2: 278. 1880.

2. **M. gracilis** Trin. Perennial; culms densely cespitose, erect from a short decumbent rhizomatous base, smooth or scabrous above, 6 to 18 inches high; sheaths smooth or scabrous; ligule 2 to 3 lines long; blades crowded at base, involute, scabrous, sharp-pointed; panicles narrow, loose, 2 to 4 inches long; glumes broad, oblong, sparsely pubescent, 1 line long, obtuse or more or less erose at apex, the second 3-toothed; lemma 1½ lines long, sparsely pubescent at base and margins, gradually narrowed into a slender, more or less flexuous awn ½ to ¾ inch long.

Dry ground, middle Sierra Nevada (Yosemite Valley, *Bolander* 6093; Mt. Tallac, *Hitchcock* 3143) to Wyoming, south into Mexico.

Refs.—MUHLENBERGIA GRACILIS Trin. Gram. Unifl. 193. 1824; Thurb. in Wats. Bot. Cal. 2: 277. 1880. *Podosaemum gracile* H.B.K. Nov. Gen. & Sp. 1: 131. 1816.

3. **M. lemmoni** Scribn. Perennial, from a creeping branching woody rhizome; culms slender, wiry, erect or ascending, 1 to 2 feet high; blades flat or somewhat involute, ½ to 1 line wide; panicles narrow, interrupted, the branches short; glumes narrow, gradually acuminate, including the awn about 1½ lines long; lemma 1½ lines long, acuminate into an awn as much as 3 lines long, the callus hairs rather sparse, about ½ as long as body of lemma.

Deserts from southern California (Jamacha, *Canby* 58) to Texas and northern Mexico.

Ref.—MUHLENBERGIA LEMMONI Scribn. Contr. Nat. Herb. 1: 56. 1890.

4. **M. californica** Vasey. Perennial, the base more or less creeping and rhizomatous; culms erect, somewhat woody below, smooth, puberulent about nodes, 1 to 2 feet high; sheaths scaberulous, keeled; ligule scarcely ½ line long; blades flat, 2 to 3 lines wide, scabrous, usually short; panicles narrow, spike-like or interrupted, 3 to 6 inches long; glumes narrow, acuminate or awn-pointed, 1½ to 2 lines long, scabrous on the keels; lemma about 1½ lines long, scabrous, the callus hairs rather sparse, about ½ as long as lemma; awn a line long or less.

Confined to southern California.

Locs.—Mt. Lowe, *Chase* 5555; Rialto, *Parish* 2113; San Bernardino Mts., *Parish Bros.* 1076, 1628; San Diego, *Orcutt.*

Refs.—MUHLENBERGIA CALIFORNICA Vasey, Bull. Torr. Club 13: 53. 1886; Abrams, Fl. Los Ang. 32. 1904. *M. glomerata* Trin. var. *brevifolia* Vasey, Bot. Gaz. 7: 92. 1882, type *Parish Bros.* 1028. *M. parishii* Vasey, Bull. Torr. Club 13: 53. 1886, type *Parish Bros.* 1076 (the glumes extended into awns ½ line long). *M. sylvatica* Torr. var. *californica* Vasey, Bot. Gaz. 7: 93. 1882, type *Parish Bros.* 1076.

5. **M. microsperma** Trin. Annual, often purple; culms spreading, 6 to 15 inches high, scaberulous especially below the nodes; sheaths smooth or scaberulous; ligule ½ line long; blades 1 to 2 inches long, ½ line wide, flat, scabrous; panicles narrow, loose, 1 to 3 inches long; glumes ovate, obtuse or emarginate, 1-nerved, unequal, the second the longer, ½ line long; lemma narrow, acuminate, 3-nerved, 1½ lines long, appressed-pubescent on margins and callus; awn terminal, capillary, 5 to 7 lines long.—Cleistogamous spikelets are developed at the base of the lower sheaths. These are solitary or few in a fascicle in each axil, each spikelet included in the indurated thickened,

tightly rolled prophyllum. The glumes are wanting and awn of the lemma reduced, but the grain is larger than that of the spikelets in the terminal inflorescence, being about the same length (1 line) but much thicker. The prophyllum enclosing the spikelet is narrowly conical and readily disarticulates from the plant at maturity.

Open ground from middle and southern California to Arizona and northern Mexico. Carmel Bay (*Elmer* 5085) and San Luis Obispo (*Brewer* 466) southward, extending east to Kern Cañon (*Heller* 7654) and The Needles (*Chase* 5792).

Refs.—MUHLENBERGIA MICROSPERMA Trin. Gram. Unifl. 193. 1824 (by inference only); Kunth, Rév. Gram. 1: 64. 1829. *Trichochloa microsperma* DC. Cat. Pl. Monsp. 151. 1813. *Muhlenbergia debilis* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4^1: 295. 1840; Thurb. in Wats. Bot. Cal. 2: 277. 1880; Abrams, Fl. Los Ang. 32. 1904. *Podosaemum debile* H.B.K. Nov. Gen. & Sp. 1: 128. 1816.

6. **M. porteri** Scribn. Perennial; culms woody or persistent at base, numerous, wiry, widely spreading or ascending through bushes, scaberulous, more or less branched from all the nodes, 1 to 3 feet long or more; sheaths smooth, spreading away from the branches, the prophyllum conspicuous; blades small, flat, 1 to 2 inches long, early deciduous from the sheath; panicles 2 to 4 inches long, open, the slender branches and branchlets brittle, widely spreading, bearing rather few, long-pediceled spikelets; glumes narrow, acuminate, slightly unequal, the second longer, about 1 line long; lemma purple, acuminate, minutely pilose, 1½ to 2 lines long, the awn about 3 lines long.

Rocky deserts from southern California (San Felipe, San Diego Co., *Parish Bros.* 1529) to Texas and northern Mexico.

Ref.—MUHLENBERGIA PORTERI Scribn.; Beal, Grasses N. Am. 2: 259. 1896.

7. **M. jonesii** Hitchc. n. comb. Perennial; culms cespitose, erect, slender, about 1 foot high; blades mostly basal, involute, flexuous, scabrous; panicles narrow, loose, 2 to 3 inches long; glumes equal, obtuse, toothed at apex, a little more than ½ line long; lemma 2 lines long, acuminate, awn-pointed.

Only known from northeastern California.

Locs.—Mt. Shasta, *Palmer* 2640 in 1892; Warner Valley, *Austin* 1230; Silver Lake, *Baker & Nutting;* Prattville, *Jones;* French Meadows, Placer Co., *Kennedy & Doten* 408.

Refs.—MUHLENBERGIA JONESII Hitchc. *Sporobolus jonesii* Vasey, Bot. Gaz. 6: 297. 1881, type from Soda Springs, *Jones* in 1881.

8. **M. filiformis** Rydb. Annual or sometimes apparently perennial, rather soft and lax, spreading from a cluster of fibrous roots or with decumbent creeping, apparently perennial bases; culms capillary, a few inches to as much as a foot high, often depauperate; blades flat, usually less than an inch long; panicles narrow, interrupted, few-flowered, an inch long or less; glumes ovate, ½ line long; lemma lanceolate, acute, mucronate, 1 line long, minutely pubescent, scaberulous at tip.

Mountain meadows from Siskiyou Co. (*Butler* 1768) south through the Sierra Nevada to Sequoia Nat. Park (*Hitchcock* 3420), San Bernardino Mts. (*Parish* 2101, 3293), and San Jacinto Mts. (*Hall* 2290); Washington to Montana and southward in the mountains to Arizona.

Refs.—MUHLENBERGIA FILIFORMIS Rydb. Bull. Torr. Club 32: 600. 1905. *Vilfa depauperata* Torr. var. *filiformis* Thurb.; Wats. King's Expl. 376. 1871. *V. gracillima* Thurb. in Wats. Bot. Cal. 2: 268. 1880 (based upon two specimens, Sierra Nevada, *Brewer*, and Yosemite Valley, *Bolander*), not *Muhlenbergia gracillima* Torr. 1856. *Sporobolus filiformis* Rydb. Contr. Nat. Herb. 3: 189. 1895.

9. **M. repens** Hitchc. n. comb. Perennial from woody creeping rhizomes;

culms slender, wiry, widely spreading or creeping, 6 to 15 inches long, flower-bearing branches ascending; blades involute, arcuate, ½ to 1½ inches long; panicles narrow, interrupted, few-flowered, ½ to 1 inch long; glumes ovate, acute, ¾ line long, smooth; lemma exceeding the glumes, about 1 line long, smooth or sparsely pubescent, acute or mucronate.

Deserts of Inyo Co. (Funeral Mts., *Coville & Funston* 228), and of Arizona and northern Mexico.

Refs.—MUHLENBERGIA REPENS Hitchc. *Sporobolus repens* Presl, Rel. Haenk. 1: 241. 1830.

10. **M. squarrosa** Rydb. Perennial from numerous hard creeping rhizomes; culms wiry, erect or decumbent at base, from a few inches to as much as 2 feet in height; blades flat or usually involute, ½ to 2 inches long; panicle narrow, interrupted, or sometimes rather close and spike-like, 1 to 6 inches long; glumes ovate, ½ line long; lemma lanceolate, acute, mucronate, 1 line long.

Dry ground, from Lake Tahoe region (Donner Lake, *Heller* 7040) to San Jacinto Mts. (*Hall* 786, 2477); Washington to Montana, south to Mexico.

Refs.—MUHLENBERGIA SQUARROSA Rydb. Bull. Torr. Club 36: 531. 1909. *Vilfa squarrosa* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4: 100. 1840. *V. depauperata* Torr.; Hook. Fl. Bor. Am. 2: 257. 1840, not *Muhlenbergia depauperata* Scribn.; Thurb. in Wats. Bot. Cal. 2: 267. 1880. *Sporobolus depauperatus* Scribn. Bull. Torr. Club 10: 63. 1883.

17. CRYPSIS Ait.

Spikelets 1-flowered, in close depressed heads, subtended by 2 inflated sheaths with thorn-like blades. Glumes obtuse. Lemma and 1-nerved palea, white, membranaceous, longer than the glumes. Much branched, spreading annual.—Species 1, Mediterranean region, introduced elsewhere. (Greek krupsis, hiding, from the partially concealed inflorescence.)

1. **C. aculeata** Ait. Plants prostrate, a foot in diameter, or often depauperate, only an inch or two wide; glumes about 1½ lines long, minutely hispid, about equal in length, the first narrower; lemma about as long as the glumes, scabrous on keel.

In overflowed land of the interior valley: Norman, Colusa Co., *Davy;* Stockton, *K. Brandegee*.

Refs.—CRYPSIS ACULEATA Ait. Hort. Kew. 48. 1789. *Schoenus aculeatus* L. Sp. Pl. 42. 1753.

18. PHLEUM L.

Spikelets 1-flowered, flattened, in dense cylindrical spike-like panicles. Glumes equal, ciliate on the keels, abruptly awn-pointed. Lemma shorter than the glumes, truncate, hyaline, 5-nerved. Palea narrow, about equaling the lemma. Erect perennials with flat blades.—Species 10, temperate and cool regions of the world, 1 a native of America. (Greek phleos, a kind of reed.)

Heads cylindrical, several times longer than wide..........................1. *P. pratense.*
Heads ovoid or oblong, 1½ to 2 times as long as broad.......................2. *P. alpinum.*

1. **P. pratense** L. TIMOTHY. Culms 2 to 4 feet high, from a swollen or bulb-like base; panicles long-cylindrical, 1 to 4 inches long; awn of glumes ½ line long.

Commonly escaped from cultivation, along roadsides and in fields and waste places.

Refs.—PHLEUM PRATENSE L. Sp. Pl. 59. 1753; Thurb. in Wats. Bot. Cal. 2: 262. 1880; Davy in Jepson, Fl. W. Mid. Cal. 39. 1901; Abrams, Fl. Los Ang. 33. 1904.

2. **P. alpinum** L. Culms 8 inches to 1½ feet high, from a decumbent, some-

what creeping base; panicles ellipsoidal or short-cylindrical; awn of glumes 1 line long, giving the head a bristly appearance.

Common in mountain meadows, bogs and swamps, in the high Sierra Nevada, and in the Coast Ranges as far south as Mendocino Co.; also in the San Jacinto Mts. Throughout the cooler regions of Eurasia and North America and extending south in the mountains to Mexico and South America.

Refs.—PHLEUM ALPINUM L. Sp. Pl. 59. 1753; Thurb. in Wats. Bot. Cal. 2: 263. 1880; Davy in Jepson, Fl. W. Mid. Cal. 40. 1901.

19. ALOPECURUS L.

Spikelets 1-flowered, flattened, falling from the axis entire, in dense cylindrical spike-like panicles. Glumes equal, awnless, usually connate at base, ciliate on the keel. Lemma broad, obtuse, 5-nerved, about as long as glumes, bearing a slender erect dorsal awn from below the middle, the margins connate near the base. Palea none. Slender annual or perennial grasses, with flat blades and soft panicles. Species about 20, temperate regions, mostly the northern hemisphere. (Greek alopex, fox, and oura, tail.)

Spikelets 1½ lines long; panicles oblong, 3 lines wide. 1. A. californicus.
Spikelets 1 line long; panicles narrow, about 2 lines wide.
  Awn scarcely exserted. 2. A. aristulatus.
  Awn protruding about 1 line. 3. A. geniculatus.

1. **A. californicus** Vasey. Culms 6 inches to 2 feet high; sheaths inflated; panicles oblong, 1 to 2 inches long, about 3 lines wide; glumes 1½ lines long; lemma sparsely pilose on the sides, the awn exserted about 1½ lines.

Meadows and wet places mostly in the Coast Ranges from Willits (*Davy* 655) to San Diego (*Brandegee* 3677); also in Merced Co. (*Congdon*). Alaska to Montana and the mountains of Arizona.

Refs.—ALOPECURUS CALIFORNICUS Vasey, Bull. Torr. Club 15: 13. 1888, type from Santa Cruz, *Anderson* in 1887; Davy in Jepson, Fl. W. Mid. Cal. 41. 1901. *A. pratensis* [L. misapplied by] Thurb. in Wats. Bot. Cal. 2: 263. 1880.

A. PRATENSIS L., the cultivated Meadow Fox-tail, is reported by Davy Jepson, Fl. W. Mid. Cal. 40. 1901) as being occasionally naturalized. It resembles A. californicus but has larger spikelets, about 3 lines long.

2. **A. aristulatus** Michx. Culms erect or spreading, 6 inches to 2 feet high; panicles narrow-cylindrical, 1 to 3 inches long, about 2 lines wide; glumes 1 line long; awn of lemma short, scarcely exserted.

In water and wet places throughout the California mountains; common in the cooler parts of North America.

Refs.—ALOPECURUS ARISTULATUS Michx. Fl. Bor. Am. 1: 43. 1803; Thurb. in Wats. Bot. Cal. 2: 263. 1880. *A. geniculatus* L. var. *aristulatus* Torr. Fl. North. & Mid. U. S. 97. 1823; Davy in Jepson, Fl. W. Mid. Cal. 41. 1901.

3. **A. geniculatus** L. Differs from A. aristulatus in being more or less decumbent at base, and in having a longer awn exserted about 1 line.

In water and wet places, the cooler parts of America and Eurasia, rare in California: San Diego (*Orcutt* 3148).

Refs.—ALOPECURUS GENICULATUS L. Sp. Pl. 60. 1753; Thurb. in Wats. Bot. Cal. 2: 269. 1880; Davy in Jepson, Fl. W. Mid. Cal. 41. 1901; Abrams, Fl. Los Ang. 33. 1904.

20. SPOROBOLUS R. Br.

Spikelets 1-flowered, in narrow or open panicles. Glumes awnless, nearly or quite nerveless, usually unequal. Lemma equaling or exceeding the glumes, awnless. Palea equaling or exceeding the lemma. Grain readily falling from the spikelet, the pericarp loosely enclosing the seed, often thin and evanescent

Annuals or perennials with small spikelets.—Species about 80, mostly American, from the warmer regions. (Greek spora, seed, and bolos, throwing.)

Plants annual; spikelets ½ line long.......................................1. *S. confusus.*
Plants perennial; spikelets 1 line long or more.
  Plants densely cespitose, erect; without rhizomes..........................2. *S. airoides.*
  Plants not cespitose, decumbent-spreading; rhizomes present...........3. *S. asperifolius.*

1. **S confusus** Vasey. Annual; culms slender, 6 to 8 inches high, often depauperate; blades mostly less than an inch long; panicles oblong, diffuse, often more than ½ the length of the entire plant, the branches capillary, spreading, 1 to 1½ inches long; spikelets ½ to ¾ line long, the glumes about ½ as long, equal, obtuse, sparsely pilose.

Open sandy or gravelly, usually moist ground, mostly near streams or lakes in the Sierra Nevada. Washington and Montana to Texas, Mexico and Lower California. Donner Lake, *Heller;* Mono Lake, *Bolander* 6096; Yosemite Valley, *Hitchcock* 3218.

Refs.—SPOROBOLUS CONFUSUS Vasey, Bull. Torr. Club 15: 293. 1888. *Vilfa confusa* Fourn. Mex. Pl. 2: 101. 1886. *Sporobolus ramulosus* [Kunth, misapplied by] Thurb. in Wats. Bot. Cal. 2: 269. 1880.

2. **S. airoides** Torr. Perennial; culms densely cespitose, forming large tussocks, smooth, stout, spreading at base, 1 to 3 feet high; sheaths smooth, sparsely pilose at the throat; blades involute, elongated, the upper short; panicles diffuse, finally about ½ the length of the entire plant; spikelets ¾ to 1 line long, obtuse; glumes unequal, the first oval, ½ as long as spikelet, the second as long as spikelet.

Bottomlands and valleys, often in saline or alkaline soil: Amador Co. (*Braunton* 1229) to Tia Juana (*Abrams* 3467), east in the Mohave (Newberry, *Hall* 6120) and Colorado (*Hall* 5885) deserts. Oregon to South Dakota, south into Mexico.

Refs.—SPOROBOLUS AIROIDES Torr. U. S. Rep. Expl. Miss. Pacif. 7: 21. 1856; Thurb. in Wats. Bot. Cal. 2: 269. 1880; Abrams, Fl. Los Ang. 34. 1904. *Agrostis airoides* Torr. Ann. Lyc. N. Y. 1: 151. 1824.

3. **S. asperifolius** Nees & Meyen. Perennial from creeping rhizomes; culms 1 to 2 feet long, ascending from a creeping or decumbent base; sheaths smooth, keeled; blades flat, 1 to 2 inches long, about 1 line wide, scabrous; panicles diffuse, tardily exserted from the uppermost sheath, oval, 4 to 6 inches long; spikelet ¾ line long, the glumes slightly unequal, a little shorter than the spikelet.

Meadows and wet places, especially in alkaline soil, from Lassen Co. (*Davy*) to Death Valley (*Coville & Funston* 246), Riverside (*Reed* 1950) and northern Ventura Co. (*Elmer* 3973). British Columbia to North Dakota, south to Texas and Mexico.

Refs.—SPOROBOLUS ASPERIFOLIUS Nees & Meyen, Acta Acad. Leop. Cur. 19: 141. 1843; Thurb. in Wats. Bot. Cal. 2: 269. 1880; Abrams, Fl. Los Ang. 34. 1904. *Vilfa asperifolius* Nees & Meyen; Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4^1: 95. 1840.

21. **EPICAMPES** Presl.

Spikelets 1-flowered, in elongated, narrow or spike-like panicles. Glumes 2, membranaceous. Lemma 3-nerved, of same texture as glumes and as long or longer, mucronate or short-awned. Palea about as long as lemma. Tall perennial bunch-grasses with pale many-flowered panicles and long narrow usually involute blades.—Species about 12, southern California to the Andes. (Greek epicampes, curved.)

1. **E. rigens** Benth. Culms erect, 3 to 4 feet high; sheaths smooth or slightly scabrous, covering the nodes; ligule truncate, ½ to 1 line long; blades scabrous, elongated, involute, tapering into a long slender point; panicle spike-like, slender, a foot long or more; glumes 1 to 1½ lines long, oblong, obtuse or somewhat erose, puberulent, convex, scarcely keeled, striate; lemma slightly exceeding the glumes, scaberulous, sparsely pilose at base, 3-nerved toward the narrowed summit, awnless.

Dry or open ground, hillsides, gullies and open forest: Butte Co. (Deep Creek Cañon, *Brewer* 1468) to Santa Barbara (*Elmer* 3743), San Diego (*Orcutt* 520 and San Jacinto Mts. (*Hall* 2427); east to New Mexico and south into Mexico.

Refs.—EPICAMPES RIGENS Benth. Jour. Linn. Soc. Bot. 19: 88. 1881; Abrams, Fl. Los Ang. 35. 1904. *Cinna macroura* [Kunth, misapplied by] Thurb. in Wats. Bot. Cal. 2: 276. 1880

22. POLYPOGON Desf.

Spikelets 1-flowered, in dense terminal panicles. Glumes 2, ending in a long slender straight awn. Lemma much shorter than the glumes, hyaline, short-awned. Annual or perennial, spreading weedy grasses, with flat blades and bristly panicles.—Species about 10, mostly in the warmer regions of the Old World. (Greek polus, much, and pogon, beard.)

Awns ½ to 1½ lines long; panicle somewhat lobed........................1. *P. littoralis*.
Awns 3½ to 5 lines long; panicle compact..........................2. *P. monspeliensis*.

1. **P. littoralis** Smith. Perennial; culms geniculate at base, 1 to 2½ feet high; sheaths scabrous; ligule 1 to 2 lines long or the uppermost longer; panicles oblong, 2 to 6 inches long, more or less interrupted or lobed; glumes equal, seabrous on back and keel, 1 to 1½ lines long, terminated by an awn as long; lemma smooth and shining, ½ line long, minutely toothed at the truncate apex; awn about as long as the glumes.

Introduced from Europe, from Vancouver Island to New Mexico. In California in waste places, especially along irrigating ditches at moderate altitudes, from Siskiyou Co. (*Butler* 481) to San Diego.

Refs.—POLYPOGON LITTORALIS Smith, Comp. Fl. Brit. 13. 1800; Thurb. in Wats. Bot. Cal. 2: 270. 1880; Davy in Jepson, Fl. W. Mid. Cal. 42. 1901; Abrams, Fl. Los Ang. 36. 1904. *Agrostis littoralis* With. Arr. Brit. Pl. ed. 3. 2: 129. 1796.

2. **P. monspeliensis** Desf. Annual; culms erect or decumbent at base, scabrous below panicle, depauperate or as much as 3 feet long; sheaths smooth, the ligule large; panicles dense and spike-like, 1 to 6 inches long, ½ to 1 inch wide, tawny-yellow; glumes obtuse, hispidulous, 1 line long, terminating in an awn 3 to 4 lines long; lemma as in P. littoralis.

Introduced from Europe; common throughout California in waste places and along irrigating ditches at moderate altitudes; occasional in Atlantic States, common on Pacific Coast from Alaska to Mexico.

Refs.—POLYPOGON MONSPELIENSIS Desf. Fl. Atlant. 1: 67. 1798; Thurb. in Wats. Bot. Cal. 2: 270. 1880; Davy in Jepson, Fl. W. Mid. Cal. 42. 1901; Abrams, Fl. Los Ang. 35. 1904. *Agrostis monspeliensis* L. Sp. Pl. 61. 1753.

23. CINNA L.

Spikelets 1-flowered, articulated below the glumes, in rather loose panicles. Glumes 2, slightly unequal, acute. Lemma similar to the glumes, 3 to 5-nerved, mucronate from between the minute teeth of the bifid apex, raised on a short naked stipe, the rachilla prolonged behind the palea as a short smooth bristle. Palea apparently 1-nerved, the 2 nerves close together. Stamen 1.

Tall perennials with flat blades and nodding panicles.—Species 3, northern regions of Europe, Asia, and America. (Greek kinna, a name used by Dioscorides for a kind of grass.)

1. **C. latifolia** Griseb. Culms 2 to 4 feet high; blades 5 to 7 lines wide; panicle 6 to 12 inches long, the flexuous capillary branches spreading or drooping; glumes about equal, scabrous, 2 lines long; lemma about equaling the glumes short-awned; palea 2-nerved, the nerves close together.

In moist places in woods and along streams, extending southward in the southern Sierra Nevada; also in cooler regions of North America and Eurasia.

Locs.—Mt Tallac, [illegible] 3150; Yosemite Nat. Park, *Bolander* 6090; Sequoia Nat. Park, Alta Meadow, [illegible] 237; [illegible] Meadow, [illegible] 2279.

Refs.—[illegible] Griseb. in Ledeb. Fl. Ross. 4: 435. 1853. *Agrostis latifolia* Trev.; Goepp. Beschr. Bot. Gaert. in Breslau 82. 1830. *Cinna pendula* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4: 280. 1840. *C. arundinacea* L. var. *pendula* Gray, Man. ed. 2. 545. 1856; Thurb. in Wats. Bot. Cal. 2: 276. 1880. *C. bolanderi* Scribn. Proc. Acad. Phila. 1884: 290. 1884, [illegible]

24. AGROSTIS L.

Spikelets 1-flowered, in narrow or open panicles. Glumes subequal, acute or acuminate. Lemma shorter than the glumes, thin, obtuse, awnless or awned from the back. Palea small, minute, or wanting. Rachilla (except in sect. Podagrostis) not prolonged. Annual or usually perennial, slender grasses with small spikelets.—Species about 100, distributed over the entire world, especially in the north temperate zone. (An ancient Greek name of a forage grass, from agros, a field.)

Rachilla prolonged [illegible] (Podagrostis [illegible]) ... 1. *A.* [illegible]
Rachilla not prolonged.
  Palea evident, 2-nerved.
    [illegible] ... 4. *A.* [illegible]
    [illegible]
      Panicle contracted, lobed or verticillate; glumes scabrous on keel and back........... 2. *A. stolonifera.*
      Panicle open or contracted, but not lobed; glumes scabrous on keel, smooth on back.... 3. *A. alba.*
  Palea wanting or a small nerveless scale.
    [illegible] ... 5. *A.* [illegible]
    Lemma awnless or short-awned; perennials.
      Plants spreading by rhizomes (cf. A. lepida with short rhizomes).
        [illegible] ... 6. *A.* [illegible]
        Tuft of hairs minute or wanting.
          Panicle contracted ....7. *A. pallens.*
          Panicle open..8. *A. foliosa.*
      Plants tufted, not producing rhizomes or only very short ones.
        Panicle narrow, usually a part of the lower branches spikelet-bearing from base.
          Panicle strict, branches short and appressed; plant low and cespitose............. 9. *A. breviculmis.*
          Panicle narrow but not strict.
            Lemma with an exserted awn.
              Glumes awn-pointed; panicle narrow and rather compact...10. *A. microphylla.*
              Glumes acute but not awn-pointed; panicle more open and verticillate........ 11. *A. ampla.*
            Lemma awnless or the awn included.
              Panicle 2 to 12 inches long; a taller plant of low altitudes...12. *A. exarata.*
              Panicle short, 1 to 2 inches long; a dwarf plant of high altitudes........ 13. *A. rossae.*
        Panicle open, sometimes diffusely spreading; usually no short branches in lower whorls of branches.

Lemma awned; panicle purple; ligule 2½ to 4 lines long... 18. *A. longiligula.*

Lemma awnless; ligule usually short.

Panicle very diffuse; spikelets clustered toward end of branchlets........... 14. *A. hiemalis.*

Panicle open, but not conspicuously diffuse.

Plants producing short rhizomes...........................17. *A. lepida.*

Plants not producing rhizomes.

Plants delicate, 4 to 12 inches high....................15. *A. idahoensis.*

Plants taller, over 1½ feet high......................16. *A. schiedeana.*

1. **A. thurberiana** Hitchc. Culms slender, erect, 8 to 15 inches high; panicle narrow, lax, more or less drooping, 2 to 3 inches long; spikelets green or pale, rarely purple, 1 line long; lemma nearly as long as glumes, the palea about ⅔ as long; rachilla prolonged behind the palea as a minutely hairy pedicel, ⅙ line long.

Bogs and moist places in the high Sierra Nevada, north and east to British Columbia and Montana.

Locs.—Siskiyou Co., *Butler* 1767; Pine Creek, Lassen Co., *Baker & Nutting;* Calaveras Co., *Hillebrand* 2251; Lake Chiquita, *Congdon;* Mariposa Co., *Bolander* 6102; Yosemite Nat. Park, *Hitchcock* 3269, 3338; Northfork, *Griffiths* 6652; Sequoia Nat. Park, *Hitchcock* 3366, 3407, 3473.

Refs.—AGROSTIS THURBERIANA Hitchc. U. S. Dept. Agr. Bur. Pl. Ind. Bull. 68: 23. pl. 1. f. 1. 1905. *A. aequivalvis* [Trin. misapplied by] Thurb. in Wats. Bot. Cal. 2: 271. 1880.

2. **A. stolonifera** L. Culms usually decumbent at base, sometimes with long creeping and rooting stolons; panicle contracted, lobed or verticillate, especially at base, 1½ to 4 inches long, light green or rarely purplish, the branches spikelet-bearing from the base; glumes equal, obtuse, scabrous on back and keel, 1 line long; lemma ½ line long, awnless, truncate and toothed at apex; palea nearly as long as the lemma.—Resembles in habit Polypogon littoralis, which differs in having awned glumes.

Moist ground, especially along irrigation ditches, at low altitudes from Mendocino Co. south, near the coast, and from Mariposa Co. and Inyo Co. south, especially abundant in the irrigated regions of the southern part of the state: southeast to Texas and Mexico. Introduced from Europe.

Refs.—AGROSTIS STOLONIFERA L. Sp. Pl. 62. 1753. *A. verticillata* Vill. Prosp. 16. 1779; Thurb. in Wats. Bot. Cal. 2: 272. 1880; Davy in Jepson, Fl. W. Mid. Cal. 43. 1901; Abrams, Fl. Los Ang. 36. 1904.

3. **A. alba** L. REDTOP. Culms erect or decumbent and rooting at base, 1 to 3 feet high, sending out from the base rhizomes or stolon-like stems; panicle loose but not diffuse, 2 inches to 1 foot long, the lower branches in whorls; glumes acute, 1 to 1½ lines long, scabrous on keel but not on back; lemma a little shorter than the glumes, obtuse, rarely awned on back; palea ½ to ⅔ as long as lemma.

Cultivated as a meadow grass and frequently escaped along roadsides and in waste places; apparently not native in California.

Var. **maritima** Meyer. Differs from A. alba in having decumbent rooting base and often widely spreading short-bladed stolons, and narrow contracted panicles.—Along the coast of Europe and North America; Pacific Coast from Sonoma Co. north to British Columbia. Upon the moist sand dunes the stolons are conspicuous.

Locs.—Crescent City, *Davy & Blasdale* 5944; Ft. Bragg, *Davy & Blasdale* 6124; Russ Ranch, *Davy & Blasdale* 6203; Guerneville, *Davy & Blasdale* 6003.

Refs.—AGROSTIS ALBA L. Sp. Pl. 63. 1753; Thurb. in Wats. Bot. Cal. 2: 271. 1880. Var. MARITIMA Meyer, Chloris Hanov. 656. 1836. *A. maritima* Lam. Encycl. 1: 61. 1783. The variety was referred to *A. depressa* Vasey, by Hitchcock, U. S. Dept. Agr. Bur. Pl. Ind. Bull. 68: 28. 1905, and to *A. alba* L. var. *stolonifera* "Auct.", by Davy in Jepson, Fl. W. Mid. Cal. 43. 1901.

4. **A. glomerata** Kunth. Culms erect, 8 to 12 inches high, scabrous below panicle; sheaths conspicuously striate, often inflated; panicle close and spike-like, ½ to 3 inches long, the large forms more or less lobed; glumes 1½ lines long, sharp pointed but usually not awned; lemma 1 line long, awnless or with a straight or bent awn from the middle of the back, the callus hairs short; palea ¼ line long, 2-nerved.

Along the coast from Mendocino Co. to Monterey; also Vancouver Island, Oregon and Peru.

Locs.—Mendocino, *Pringle;* Ft. Bragg, *Bolander* 6466, *Davy & Blasdale* 6167; Pt. Arena, *Davy & Blasdale* 6025; Pt. Reyes, *Davy* 6746, 6793; Pacific Grove, *Hitchcock* 2607.

Refs.—AGROSTIS GLOMERATA Kunth, Enum. Pl. 1: 219. 1833. *Vilfa glomerata* Presl, Rel. Haenk. 1: 239. 1830. *Agrostis californica* Trin. Mém. Acad. St. Pétersb. VI Sci. Nat. 4^1: 359. 1840; Thurb. in Wats. Bot. Cal. 2: 273. 1880, under *A. exarata.* *A. mucronata* [Presl, misapplied by] Thurb. in Wats. Bot. Cal. 2: 272. 1880. *A. densiflora* Vasey, Contr. Nat. Herb. 3: 72. 1892, type from Santa Cruz, *Anderson;* Davy in Jepson, Fl. W. Mid. Cal. 43. 1901.

5. **A. exigua** Thurb. Annual; culms delicate, 1 to 4 inches high; panicle ½ the length of plant, finally open; glumes ¾ line long, scaberulous; lemma equaling the glumes, bearing below the tip a slender awn 4 times as long; palea wanting.

Only known from the type collection, "Foothills of the Sierras," *Bolander.*

Ref.—AGROSTIS EXIGUA Thurb. in Wats. Bot. Cal. 2: 275. 1880.

6. **A. hallii** Vasey. Culms erect, stout, 2 to 3 feet high, bearing rhizomes; ligule usually conspicuous; panicle 4 to 5 inches long, narrow, open; glumes about 2 lines long; lemma awnless, 1½ lines long, with a tuft of hairs at base about ½ as long; palea wanting.

Mostly in woods, near the coast from Santa Barbara (*Hitchcock* 2580) to Del Norte Co. (*Davy & Blasdale* 5918); north to Oregon.

Var. **pringlei** Hitchc. Differs from A. hallii in the narrower and more compact panicles, narrower and more involute blades and the more stramineous appearance of the whole foliage. Near the coast, Mendocino Co.: Mendocino, *Congdon, Davy & Blasdale* 6075; Pt. Arena, *Davy & Blasdale* 6030.

Refs.—AGROSTIS HALLII Vasey, Contr. Nat. Herb. 3: 74. 1892. *A. davyi* Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 30: 3. 1901, type *Davy & Blasdale* 6062. Var. PRINGLEI Hitchc. U. S. Dept. Agr. Bur. Pl. Ind. Bull. 68: 33. 1905. *A. pringlei* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 7: 156. 1897, type from Mendocino Co., *Pringle.*

7. **A. pallens** Trin. Culms 8 to 15 inches high, erect, from creeping rhizomes; panicle contracted, almost spike-like, 2 to 4 inches long; glumes 1¼ to 1½ lines long; lemma a little shorter than the glumes, awnless, the hairs at base minute; palea wanting.

Sandy soil near the coast, Marin Co. to Del Norte Co., north to Washington.

Locs.—Crescent City, *Davy & Blasdale;* Pt. Reyes, *Davy* 6682, 6839, 6880; Lands End, *Davy.*

Refs.—AGROSTIS PALLENS Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4^1: 328. 1840; Thurb. in Wats. Bot. Cal. 2: 273. 1880, under *A. exarata.*

8. **A. foliosa** Vasey. Differs from A. pallens in the taller culms, and more open panicles, the branches rather stiffly ascending; lemma awnless (in most of the California specimens) or with a straight or rarely a bent awn.

Meadows and open woods, from Humboldt Co. south along the coast, in the Sierra Nevada to Mariposa Co., and in the San Jacinto Mts. Extends north to British Columbia.

Locs. Eureka, *Davy & Blasdale* 6216; Siskiyou Co., *Butler* 1748; Castle Crag, *Hitchcock* 3066; Eagle Lake, *Davy;* Donner Lake, *Heller* 7076; Tahoe, *Hitchcock* 3079; Amador Co., *Hansen* 1818; Calaveras Co., *Hillebrand* 2248; Tuolumne River, *Bolander* 5064; Yosemite Valley, *Hitchcock* 3225; Pt. Reyes, *Davy* 6837; Angel Island, *Bolander* 1521; San Francisco, *Bolander* 1518, 2282; Black Mt., *Elmer* 4264; Pacific Grove, *Heller* 6848; Santa Lucia Mts., *Davy* 7702; San Jacinto Mts., *Hall* 2209; Santa Rosa Island, *Brandegee;* Santa Catalina Island, *Brandegee.*

Refs.—AGROSTIS FOLIOSA Vasey, Bull. Torr. Club 13: 55. 1886. *A. diegoensis* Vasey, Bull. Torr. Club 13: 55. 1886, type from San Diego, *Orcutt;* Davy in Jepson, Fl. W. Mid. Cal. 44. 1901; Abrams, Fl. Los Ang. 37. 1904. *A. scouleri* [Trin. misapplied by] Thurb. in Wats. Bot. Cal. 2: 272. 1880. *A. pallens* Trin. var. *foliosa* Hitchc. U. S. Dept. Agr. Bur. Pl. Ind. Bull. 68: 34. 1905

9. **A. breviculmis** Hitchc. Culms cespitose, erect, 4 to 6 inches high; panicle strict and narrow, about an inch long; glumes 1½ lines long, acute; lemma a little more than ½ as long as glumes, awnless or bearing a very short awn near the middle of the back; palea a minute nerveless scale.

On cliffs, Ft. Bragg, Mendocino Co., *Bolander* 6466 in part, *Davy & Blasdale* 6159. Also in Peru.

Refs.—AGROSTIS BREVICULMIS Hitchc. U. S. Dept. Agr. Bur. Pl. Ind. Bull. 68: 36. 1905. *A. nana* Kunth, Enum. Pl. 1: 226. 1833, not Delarbre 1800.

10. **A. microphylla** Steud. Culms 1½ to 3 feet tall, or often depauperate; panicle narrow, close and spike-like, or rather loose, 4 to 12 inches long, the branches spikelet-bearing to the base; glumes 1½ lines long, more or less awn-pointed; lemma ⅓ shorter than glumes, bearing at the middle an exserted bent awn; palea wanting.

Open ground, prairies, dry hills and open woods, along the coast from Mendocino Co. to Monterey Co., and in the interior from Yosemite Nat. Park to Tulare Co.; also at San Diego (*Orcutt* 1173, 1176). British Columbia to Mexico.

Refs.—AGROSTIS MICROPHYLLA Steud. Syn. Pl. Glum. 1: 164. 1854; Thurb. in Wats. Bot. Cal. 2: 273. 1880, under *A. exarata.*

11. **A. ampla** Hitchc. Culms 2 to 3 feet high; blades broad, 2½ to 4 lines wide; panicle large and spreading, 8 to 10 inches long, branches verticillate, the shorter ones spikelet-bearing from the base; glumes unequal, acuminate but not awn-pointed, the first 2 lines long; lemma 1¼ lines long, bearing a straight or bent awn at the middle; palea a minute, nerveless scale.

Moist ground, near the coast and in interior valleys; north to British Columbia and east to Arizona.

Locs. Blairs, Mendocino Co., *Davy & Blasdale* 5262; Mendocino, *Brown* 799; Ft. Bragg, *Davy & Blasdale* 6118; Round Valley, *Chesnut* 94; Cloverdale, *Bolander* 6465; Auburn, *Shockley* 547, *Palmer* 2420 in 1892; Middle Fork Tule River, *Purpus* 5638; Colton, *Jones.*

Refs.—AGROSTIS AMPLA Hitchc. U. S. Dept. Agr. Bur. Pl. Ind. Bull. 68: 38. pl. 20. 1905. *A. virescens* [H.B.K. misapplied by] Thurb. in Wats. Bot. Cal. 2: 274. 1880.

12. **A. exarata** Trin. Culms erect, 2 to 4 feet high, or often depauperate; panicle contracted and spike-like or loose and somewhat spreading, the branches densely flowered; glumes 1¼ to 1¾ lines long, scabrous on the keel and usually on the back; lemma 1 line long, awnless, or rarely with a short prickle on the back; palea a minute nerveless scale ⅙ line long.

Moist places, common throughout the state, especially near the coast and in the mountains up to 9000 feet; extends from Alaska to Mexico.

Refs.—AGROSTIS EXARATA Trin. Gram. Unifl. 207. 1824; Thurb. in Wats. Bot. Cal. 2: 273. 1880. *A. grandis* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4^1: 316. 1840; Thurb. in Wats. Bot. Cal. 2: 273. 1880, under *A. exarata.* *A. asperifolia* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4^1: 317. 1840; Thurb. in Wats. Bot. Cal. 2: 273. 1880, under *A. exarata;* Davy in Jepson, Fl. W. Mid. Cal. 44. 1901; Abrams, Fl. Los Ang. 36. 1904.

13. **A. rossae** Vasey. Culms 4 to 8 inches high; panicle contracted, 1 to 2½ inches long, the branches appressed; spikelets green or purple, 1 line long; lemma ¾ line long, awnless; palea minute.—Differs from A. exarata chiefly in the size, possibly an alpine form of that species; glumes not scabrous on the back as usual in A. exarata.

Rocky creeks and mountain slopes; in California confined to the high Sierra Nevada; north to Washington and east to Wyoming.

Locs.—Donner Pass, *Heller* 7140; Rubicon River, *Leiberg* 5346; Summit Valley, *Pringle;* Mt. Tallac, *Hitchcock* 3150; Mt. Dana, *Bolander* 5070; Yosemite Nat. Park, *Hitchcock* 3331, *Lemmon;* Kern River, *Rothrock* 323.

Refs.—AGROSTIS ROSSAE Vasey, Contr. Nat. Herb. 3: 76. 1892. *A. varians* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4^1: 314. 1840, not Thuill. 1790; Thurb. in Wats. Bot. Cal. 2: 273. 1880.

14. **A. hiemalis** B. S. P. Culms slender, tufted or scattered, 8 inches to 3 feet high, but usually delicate; leaves usually mostly basal, the blades narrow or almost setaceous; panicle very diffuse and open, as much as a foot long, the branches scabrous, long and capillary, bearing spikelets near the extremities; glumes ¾ to 1 line long, acute or acuminate; lemma ⅔ to ¾ as long as glumes; awnless or rarely awned; palea wanting.

Meadows and moist places in the Sierra Nevada and in the high mountains of southern California; extends throughout North America.

Var. **geminata** Hitchc. Differs from A. hiemalis in having a smaller, less diffuse panicle, with divaricate branches; culms usually less than a foot high; lemma awnless in the California specimens.—Arctic and alpine regions. Lassen Peak, *Jones;* Kern River, *Rothrock.*

Refs.—AGROSTIS HIEMALIS B.S.P. Prel. Cat. N. Y. 68. 1888. *Cornucopiae hiemalis* Walt. Fl. Carol. 73. 1788. *Agrostis scabra* Willd. Sp. Pl. 1: 370. 1798; Thurb. in Wats. Bot. Cal. 2: 274. 1880. Var. GEMINATA Hitchc. U. S. Dept. Agr. Bur. Pl. Ind. Bull. 68: 44. 1905. *A. geminata* Trin. Gram. Unifl. 207. 1824.

15. **A. idahoensis** Nash. Culms slender, 4 to 12 inches high; panicle loosely spreading, 2 to 4 inches long, the branches capillary, minutely scabrous; spikelets ¾ line long; lemma 1 line long, awnless; palea minute.—Differs from A. hiemalis in the narrow panicle with shorter branches.

Mountain meadows of the Sierra Nevada, San Bernardino and San Jacinto mountains, north to Washington and east to Colorado.

Locs.—Lincoln Valley, Sierra Co., *Kennedy & Doten* 195; Amador Co., *Hansen* 2079; Calaveras Co., *Hillebrand* 2247; Clarks, *Torrey* 567; Yosemite Nat. Park, *Bolander* 6106, 6107, *Hitchcock* 3230, 3342; Mono Co., *Shockley* 614; Black Mt., *Hall & Chandler* 603; Northfork, *Griffiths* 6663; Kings River, *Brewer* 2823; Sequoia Nat. Park, *Hitchcock* 3463; San Bernardino Mts., *Hall* 7618, *Parish* 3302; San Jacinto Mts., *Hall* 2363, *Reed* 2500.

Refs.—AGROSTIS IDAHOENSIS Nash, Bull. Torr. Club 24: 42. 1897. *A. tenuis* Vasey, Bull. Torr. Club 10: 21. 1883, not Sibth. 1794.

16. **A. schiedeana** Trin. Culms 2 to 3 feet high; panicle oblong, 4 to 12 inches long, open, the branches verticillate, rather stiff and ascending, the lower whorls numerous, the longer 2 to 4 inches long, branching above the middle; glumes 1¼ to 1½ lines long; lemma ¾ line long, awnless; palea small, about ¼ line long.

Wet meadows, through the high Sierra Nevada, also in the San Bernardino Mts.; extends from British Columbia to Mexico.

Locs.—Big Meadows, Placer Co., *Austin* 1196; Tahoe, *Hitchcock* 3096; Glen Alpine, *McGregor* 33; Yosemite Valley, *Bolander* 4954, 6103; San Bernardino Mts., *Parish Bros.* 1560.

Refs.—AGROSTIS SCHIEDEANA Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4^1: 327. 1840.

A. clata [Trin. misapplied by] Thurb. in Wats. Bot. Cal. 2: 274. 1880. *A. hallii* Vasey var. *californica* Vasey, Contr. Nat. Herb. 3: 74. 1892, based on the preceding.

17. **A. lepida** Hitchc. n. sp. Culms tufted, 1 to 1½ feet high, erect, producing numerous short rhizomes; ligule long, especially on the innovations, these as much as 2 lines long, narrow, pointed; blades mostly basal, firm, erect, flat or folded, the upper culm leaf below the middle of the culm, the blade short, an inch long or less; panicle purple, erect, 4 to 6 inches long, the branches in verticils, stiff and straight, becoming divaricately spreading, the lowermost 1 to 2 inches long, spikelet-bearing from about the middle, some short branches intermixed; glumes 1½ lines long, smooth or nearly so; lemma 1 line long, awnless; palea wanting or a minute nerveless scale.—(Caespitosa, 1-1½ ped. alta, recta, rhizomatibus numerosis brevibus; folia firma, recta, omnia deorsum infra culmi mediam aggregata, ligula producta, laminis 1 poll. vel brevioribus; panicula purpurascens, 4-6 pol. longa, ramis verticillatis, rigidis, patentibus; glumae 1½ lin. longae, glabrae vel subglabrae; lemma 1 lin. longum, muticum; palea obsoleta.)

Type specimen collected in open gravelly woods, Siberian Pass, Sequoia National Park, California, by A. S. Hitchcock, Sept. 6, 1908 (no. 3455 in the National Herbarium). Other specimens referred to this species, all from Sequoia National Park, are: dry rocky soil, south of Farewell Gap, *Hitchcock* 3401; in mossy place, rim of Kern Cañon, near Bench Mark 9839, specimens in somewhat isolated bunches, *Hitchcock* 3434; dense masses in meadow, around lake, east of Kern Cañon, *Hitchcock* 3435. Differs from A. idahoensis in the larger spikelets, from A. hiemalis var. geminata in the firm blades, and from all of this group, in having rhizomes.

18. **A. longiligula** Hitchc. Culms erect, about 2 feet high; ligule 2½ to 3 lines long; panicle narrow, but loosely flowered, bronze-purple, 4 to 6 inches long, the branches very scabrous; glumes 2 lines long; lemma 1¼ lines long, bearing at the middle a bent exserted awn; palea minute.

Bogs and moist places, Mendocino Co. north to Alaska.

Locs.—Mendocino, *Davy & Blasdale* 6073, 6088, 6096; Ft. Bragg, *Davy & Blasdale* 6105, 6110, 6140; between Noyo and Albion, *Bolander* 6472.

Refs.—AGROSTIS LONGILIGULA Hitchc. U. S. Dept. Agr. Bur. Pl. Ind. Bull. 68: 54. pl. 36. f. 3. 1905, type *Davy & Blasdale* 6110. *A. canina* [L. misapplied by] Thurb. in Wats. Bot. Cal. 2: 274. 1880.

25. GASTRIDIUM Beauv.

Spikelets 1-flowered, in spike-like panicles. Glumes 2, enlarged or saccate at base, much longer than the floret. Rachilla prolonged behind the palea. Lemma pubescent, truncate, hyaline, awnless or bearing an awn just below the apex. Palea narrow, about as long as the lemma. Cespitose annuals with flat blades and pale shining panicles.—Species 2. Mediterranean region. (Greek gaster, belly, referring to the saccate glumes.)

1. **G. lendigerum** Gaud. Culms about a foot high, smooth; panicle 2 to 3 inches long, dense and spike-like; glumes 1½ lines long, gradually narrowed into an awn-point; lemma much shorter than the glumes, globular, pubescent at apex, the awn 2½ lines long, geniculate.

Open ground and waste places, mostly in the Coast Ranges, at moderate altitudes. Also in Oregon and Texas. Introduced from Europe.

Refs.—GASTRIDIUM LENDIGERUM Gaud. Fl. Helv. 1: 176. 1828; Davy in Jepson, Fl. W. Mid. Cal. 45. 1901; Abrams, Fl. Los Ang. 37. 1904. *Milium lendigerum* L. Sp. Pl. ed. 2. 91. 1762. *Gastridium australe* Beauv. Ess. Agrost. 164. 1812; Thurb. in Wats. Bot. Cal. 2: 275. 1880.

26. CALAMAGROSTIS Adans.

Spikelets 1-flowered, in narrow or open panicles. Glumes subequal, usually longer than the floret. Rachilla prolonged behind the palea as a usually hairy pedicel. Lemma with 2 pairs of lateral nerves, surrounded at the base with a tuft of hairs, awned from the back usually below the middle. Palea shorter than the lemma, faintly 2-nerved. Usually tall or reed-like perennials.—Species about 120, distributed throughout the world in temperate and arctic regions. (Greek calamos, a reed, and agrostis, a grass.)

Awn longer than the glume, and geniculate.
Panicle open, the branches spreading.
Blades mostly basal, capillary..1. *C. breweri.*
Blades scattered, broad and flat......................................2. *C. bolanderi.*
Panicle compact.
Glumes about 5 lines long, gradually long-acuminate....................3. *C. foliosa.*
Glumes 3 to 4 lines long, abruptly acute or acuminate..............4. *C. purpurascens.*
Awn shorter than the glumes, straight or somewhat geniculate.
Panicle loose, the branches spreading or ascending.
Callus hairs copious, as long as lemma..............................5. *C. canadensis.*
Callus hairs sparse, shorter than lemma.
Glumes 1½ to 2 lines long.......................... ....6. *C. californica.*
Glumes 2½ to 3 lines long ....7. *C. aleutica.*
Panicle narrow, more or less spike-like.
Sheaths pubescent on collar ....8. *C. rubescens.*
Sheaths glabrous on collar.
Glumes ovate, firm or indurated, 2 lines long; awn straight.......9. *C. crassiglumis.*
Glumes lanceolate, thin.
Glumes 1½ lines long; awn straight ....10. *C. hyperborea.*
Glumes 2½ lines long; awn geniculate ....11. *C. densa.*

1. **C. breweri** Thurb. Culms slender, erect, cespitose, 6 to 12 inches high; leaves mostly basal, usually involute-filiform; panicle ovate, open, purple, 1 to 3 inches long, the lower branches slender, spreading, few-flowered, ½ to 1 inch long; glumes 1½ to 2 lines long, 1-nerved, smooth, acute; lemma nearly as long as glumes, cuspidate-toothed, the awn borne near the base, geniculate, exserted, twisted below, about 1 line long above the bend; rudiment long-pilose, 1 line long.

Mountain meadows of the high Sierra Nevada.

Locs.—Webber Lake, *Leiberg* 5259; Donner Pass, *Heller* 7130; Mt. Tallac, *Hitchcock* 3146; Yosemite Nat. Park, *Bolander* 6098, *Hall & Babcock* 3627, *Hitchcock* 3258, 3306, 3430, *Lemmon* in 1897; Sequoia Nat. Park, *Hitchcock* 3470, *Purpus* 5210.

Refs.—CALAMAGROSTIS BREWERI Thurb. in Wats. Bot. Cal. 2: 280. 1880, type from Carson Pass, *Brewer* 2128. *C. lemmoni* Kearn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 16. 1898, type collected in California by *Lemmon* in 1875.

2. **C. bolanderi** Thurb. Culms 3 to 4 feet tall; sheaths scabrous; blades flat, scattered, nearly smooth; panicle open, 4 to 8 inches long, the branches verticillate, spreading, naked below, the longer 2 to 4 inches long; glumes 1½ to 2 lines long, purple, scabrous, acute; lemma very scabrous, about as long as glumes, the awn from near base, geniculate, exserted, about 1 line long above the bend; rudiment pilose, 1 line long.

Bogs and moist ground, prairie or open woods. Mendocino and Humboldt cos. near the coast.

Locs.—Humboldt Co., *Kellogg & Harford* 1092; Mendocino, *Davy & Blasdale* 6074, 6090, *Pringle;* Pt. Arena, *Davy & Blasdale* 6128; Noyo River, *Bolander* 6471 in part, *Davy & Blasdale* 6574.

Refs.—CALAMAGROSTIS BOLANDERI Thurb. in Wats. Bot. Cal. 2: 280. 1880, type *Bolander* 6471 in part.

3. **C. foliosa** Kearn. Culms cespitose, erect, 1 to 2 feet high; leaves mostly basal, numerous, the blades involute, firm, smooth, nearly as long as culm; panicle dense, spike-like, 2 to 3 inches long; glumes 3 to 4 lines long, acuminate; lemma $2\frac{1}{2}$ to $3\frac{1}{2}$ lines long, acuminate, 4-nerved, the nerves ending in setaceous teeth; awn from near base, geniculate, about 4 lines long above the bend; rudiment pilose, nearly as long as lemma; callus hairs numerous, $1\frac{1}{2}$ lines long.

Humboldt Co. (*Bolander* 6470, *Davy* 6602) and Mendocino Co. (*Congdon*), near the coast.

Refs.—CALAMAGROSTIS FOLIOSA Kearn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 17. 1898, type *Bolander* 6470. *C. sylvatica* DC. var. *longifolia* Vasey, Contr. Nat. Herb. 3: 83. 1892 (not *C. longifolia* Hook.), type *Bolander* 6470. This is included under *C. sylvatica* by Thurber (in Wats. Bot. Cal. 2: 282. 1880).

4. **C. purpurascens** R. Br. Culms cespitose, erect, $1\frac{1}{2}$ to 2 feet high; sheaths scabrous; blades flat or more or less involute, scabrous; panicle dense, spike-like, 2 to 5 inches long, pale or sometimes purple; glumes 3 to 4 lines long, scabrous; lemma nearly as long as glumes, 4-nerved, 4-awned at apex, the dorsal awn from near base, finally geniculate, exserted about 1 line.

In mountain meadows and on rocks, chiefly of the high Sierra Nevada; extends from arctic regions to California and Colorado. The Mt. Tamalpais specimens, differing in having pale panicles and larger spikelets, may be a distinct species.

Locs.—Mt. Dana, *Congdon;* Mt. Lyell, *Hitchcock* 3301; Mt. Tamalpais, *Chase* 5685, 5687, *Congdon, Heller* 8396, *Piper* 6315.

Refs.—CALAMAGROSTIS PURPURASCENS R. Br.; Richards, Bot. App. Frankl. Jour. 731. 1823; Davy in Jepson, Fl. W. Mid. Cal. 45. 1901. *C. sylvatica* [DC. misapplied by] Thurb. in Wats. Bot. Cal. 2: 282. 1880. Var. *purpurascens* Vasey, Contr. Nat. Herb. 3: 83. 1892, type from Mt. Dana, *Bolander* 5071.

5. **C. canadensis** Beauv. Culms 2 to 4 feet tall, from creeping rhizomes; blades scattered, flat, rather lax, scabrous, 2 to 4 lines wide; panicle narrow but loose, rather open, especially at base; glumes 2 lines long, smooth, scabrous on keel, acuminate; lemma nearly as long as glumes, smooth, narrowed toward summit; callus hairs abundant, about as long as the lemma; awn delicate, straight, attached just below the middle of the lemma and extending to or slightly beyond its tip; rudiment delicate, sparsely long-pilose.

Meadows and open woods in the high Sierra Nevada from Lake Tahoe to Mt. Whitney; extends throughout the northern part of North America.

Locs.—Mt. Tallac, *Hitchcock* 3129, *McGregor* 169; Hot Springs, *Austin* 1302; Silver Lake, *Davy;* Yosemite Nat. Park, *Hitchcock* 3252, 3282, *Lemmon;* Sequoia Nat. Park, *Hitchcock* 3372, 3429, 3445, 3465.

Refs.—CALAMAGROSTIS CANADENSIS Beauv. Ess. Agrost. 15. 1812; Thurb. in Wats. Bot. Cal. 2: 279. 1880. *Arundo canadensis* Michx. Fl. Bor. Am. 1: 173. 1803.

6. **C. californica** Kearn. Culms 3 feet tall; blades flat, firm, rather rigid, 2 lines wide, those of the innovations involute; panicle 8 inches long, narrow, loose; glumes $1\frac{1}{2}$ to 2 lines long, scabrous, acuminate; lemma shorter than the glumes, strongly nerved; callus hairs abundant, $\frac{1}{2}$ as long as the lemma; awn delicate, straight, attached below the middle, extending to tip of lemma.

A little-known species resembling C. canadensis but having more rigid firm blades, and callus hairs only $\frac{1}{2}$ as long as lemma. The only specimens known are those of the type collection, from "Sierra Nevada Mts.," *Lemmon* 444 in 1875.

Ref.—CALAMAGROSTIS CALIFORNICA Kearn. U. S. Dept. Agr. Agrost. Bull. 11: 37. 1898.

7. **C. aleutica** Bong. Culms stout, 3 to 5 feet high; blades flat, becoming inrolled, elongated, gradually narrowed into a long involute point; panicle narrow, rather loose, 6 to 12 inches long, the branches rather stiffly ascending; glumes 2½ to 3 lines long, acuminate; lemma 2 lines long, indistinctly nerved, the callus hairs ½ as long; awn rather stout, attached below the middle, slightly geniculate, extending to summit of lemma.

Bogs and swamps, Monterey to Alaska, near the coast.

Locs.—Requa, *Davy & Blasdale* 5919; Mendocino, *Davy & Blasdale* 6089; Pt. Arena, *Davy & Blasdale* 6012, 6020, 6055; Ft. Bragg, *Davy & Blasdale* 6123, 6133, 6155; Noyo River, *Davy* 6576; Pt. Reyes, *Davy* 6702, 6785, 6817; San Francisco, *Bolander* 6084; San Pedro, *Elmer* 4693, 5033, 5040, 5051; Pacific Grove, *Davy* 7510, 7534, *Hitchcock* 2617.

Refs.—CALAMAGROSTIS ALEUTICA Bong. Mém. Acad. St. Petersb. VI. Math. Phys. Nat. 2: 171. 1832; Thurb. in Wats. Bot. Cal. 2: 282. 1880; Davy in Jepson, Fl. W. Mid. Cal. 46. 1901. *C. subflexuosa* Kearn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 22. 1898, type from Oakland, *Bolander* 2274; Davy in Jepson, Fl. W. Mid. Cal. 46. 1901.

8. **C. rubescens** Buckl. Culms slender, 2 to 3 feet high, from creeping rhizomes; sheaths smooth, but pubescent on the collar; blades flat or somewhat involute; panicle narrow, spike-like, pale or purple, 3 to 6 inches long; glumes 2 to 2½ lines long, narrow, acuminate; lemma pale and thin, about as long as glumes, smooth, scarcely nerved, the callus hairs about ⅓ as long; awn attached near base, geniculate, exserted at side of glumes, the terminal portion about ½ line long.

Prairies and banks, Mendocino Co. (*Pringle* in 1882) to Santa Clara Co. (*Hitchcock* 2659) and Santa Cruz (*Anderson*); north and east to British Columbia and Manitoba.

Refs.—CALAMAGROSTIS RUBESCENS Buckl. Proc. Acad. Phila. 1862: 92. 1863; Davy in Jepson, Fl. W. Mid. Cal. 47. 1901. *C. suksdorfii* Scribn. Contr. Nat. Herb. 3: 82. 1892. *C. aleutica* Bong. var. *angusta* Vasey, Contr. Nat. Herb. 3: 80. 1892, type from Santa Cruz, *Anderson*. *C. angusta* Kearn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 21. 1898, based on the preceding; Davy in Jepson, Fl. W. Mid. Cal. 46. 1901. *C. fasciculata* Kearn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 23. 1898, type from plains of Mendocino, *Pringle;* Davy in Jepson, Fl. W. Mid. Cal. 47. 1901.

9. **C. crassiglumis** Thurb. Culms rather stout, 6 inches to 1½ feet high; blades flat, or somewhat involute, smooth, firm, about 2 lines wide; panicle narrow, spike like, 1 to 2 inches long; glumes 2 lines long, ovate, rather abruptly acuminate, purple, scaberulous, firm or almost indurated; lemma about as long as glumes, broad, obtuse; callus hairs abundant, about 1½ lines long; awn attached at middle of back, straight, about as long as lemma; rudiment ½ line long, the pilose hairs reaching to apex of lemma.

Swampy soil, from Mendocino Co., the type locality and only known station in the state, to Vancouver Island.

Ref.—CALAMAGROSTIS CRASSIGLUMIS Thurb. in Wats. Bot. Cal. 2: 281. 1880, type *Bolander* 4766 (and 4787).

10. **C. hyperborea** Lange. Culms 1 to 2 feet high, producing stout rhizomes; sheaths smooth, the outer basal ones numerous, marcescent, persistent; blades loosely involute, scabrous, 1 to 2 lines wide; panicle narrow, more or less spike-like, 2 to 3 inches long; glumes 1½ lines long, scaberulous; lemma about as long as glumes, scabrous, the callus hairs ½ to ¾ as long; awn attached about the middle, straight, about as long as glumes; rudiment ¼ line long, some of the pilose hairs reaching to tip of lemma.

In mountain meadows of the high Sierra Nevada; extends from arctic North

America to northern U. S. The California specimens correspond best to var. stenodes Kearn.

Locs. Susanville, *Jones*; Lyell Fork, *Hitchcock* 3291; Kaweah Meadows, *Purpus* 5128.

Refs.—CALAMAGROSTIS HYPERBOREA Lange, Fl. Dan. 50: pl. 3. 1880. Var. *stenodes* Kearn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 39. 1898. *C. stricta* [Trin. misappled by] Thurb. in Wats. Bot. Cal. 2: 281. 1880.

11. **C. densa** Vasey. Culms 1½ to 2½ feet high, with creeping rhizomes; sheaths smooth or seabrous, no pubescence at collar or throat; blades flat or becoming somewhat involute, firm, scabrous, 1 to 2 lines wide; panicle narrow, dense, spike-like, more or less interrupted at base, 2 to 4 inches long, pale or purple; glumes about 2½ lines long, acuminate; lemma 1½ to 2 lines long, scaberulous; awn attached near base, geniculate, shorter than the glumes, the upper portion 1 line long, exserted at side of glumes; callus hairs 1 line long; rudiment about ¾ line long, the pilose hairs reaching to 1 or 1½ lines.

Prairies and banks, Oregon to California.

Locs. Siskiyou Co., *Butler* 17[illegible]; [illegible] Sonoma Co., [illegible] in 1881; [illegible] *Congdon* in 1904; Mt. Tamalpais, *Blankinship* 28; Congress Springs, *Hitchcock* 2666; Julian, San Diego Co., *Orcutt* in 1889.

Refs.—CALAMAGROSTIS DENSA Vasey, Bot. Gaz. 16: 147. 1891, type from Julian, *Orcutt*. *C. vilfaeformis* Kearn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 20. 1898, based on the preceding, the name changed because of *Deyeuxia densa* Benth. *C. koelerioides* Vasey, Bot. Gaz. 16: 147. 1891, type from Julian, *Orcutt*. *C. koelerioides* Vasey var. *densa* Beal, Grasses N. Am. 2: 345. 1896. Of C. densa, there is only the type collection, which is immature. It differs from *C. koelerioides* in being more robust (about 4 feet high) and in having a longer panicle. So far as can be determined from the immature specimen the spikelet characters are the same as those of *C. koelerioides*. The two forms are therefore provisionally united under the name C. densa which holds priority of position.

27. AMMOPHILA Host.

Spikelets 1-flowered in spike-like panicles. Glumes 2, firm, subequal, compressed-keeled, acute. Rachilla prolonged behind the palea as a hairy bristle. Lemma firm, about as long as glumes, surrounded at base with short hairs, 2-toothed at apex and mucronate between the teeth. Palea about as long as lemma, rather firm, the 2 nerves close together. A coarse perennial with creeping rhizomes, rigid culms and involute blades.—Species 1, on the sandy seacoast of Europe, the Atlantic Coast of North America, and the shores of the Great Lakes. (Greek ammos, sand, and philein, to love.)

1. **A. arenaria** Link. BEACH-GRASS. Culms stout, 2 to 3 feet high; blades elongated, gradually narrowed into an involute point; panicle 4 to 12 inches long, dense; glumes as much as 5 lines long, scabrous.

Sands of the seacoast; introduced on the Pacific Coast where it has been used as a sandbinder. Pt. Arena, *Davy* 6046; Pt. Reyes, *Elmer* 5064; San Francisco, *Heller* 5670.

Refs.—AMMOPHILA ARENARIA Link, Hort. Berol. 1: 105. 1827; Davy in Jepson, Fl. W. Mid. Cal. 47. 1901. *Arundo arenaria* L. Sp. Pl. 82. 1753.

28. LAGURUS L.

Spikelets 1-flowered, in dense capitate panicles. Glumes linear, long plumose-ciliate. Lemma narrow, smooth, 2-cleft, the divisions aristate, a dorsal awn arising from above the middle. Palea hyaline, 2-keeled. A low annual with flat blades and long-exserted, woolly panicles.—Species 1, southern Europe, sparingly introduced in California. (Greek lagos, hare, and oura, tail.)

1. **L. ovatus** L. Culms 4 to 12 inches high, slender, pubescent; leaves pubes-

cent; panicle about an inch long and nearly as thick; glumes very narrow, 5 lines long.

Berkeley, *Davy* 734; Pacific Grove, *Heller* 6701.

Ref.—Lagurus ovatus L. Sp. Pl. 81. 1753.

Tribe VI. AVENEAE.

29. **NOTHOLCUS** Nash, gen. nov.

Spikelets 2-flowered, articulated below the glumes, in contracted panicles, the lower floret perfect, awnless, the upper staminate, awned. Glumes thin, subequal, compressed, boat-shaped, longer than the florets. Lemmas somewhat indurated, boat-shaped. Palea thin, nearly as long as lemma. Perennials with flat blades and terminal panicles.—Species about 8, Europe and Africa. (Greek nothos, false, and Holcus, the generic name usually applied to this group.)—(Spiculae 2-florae, infra glumas articulatae. Flosculus inferior hermaphroditus, muticus; superior masculus, aristatus. Glumae membranaceae, subaequales, compressae, naviculiformes, flosculis longiores. Lemmata duriuscula, naviculiformia. Palea membranacea, fere lemmate aequilonga.—Gramineae perennes, foliis planis et paniculis terminalibus.)

The name Holcus being applied to the genus Sorghum, with the type, *H. sorghum*, the above genus, Holcus of most recent authors, with the type *Holcus lanatus* L., must receive a new name. The section *Homalachna* Benth. & Hook. (Gen. Pl. 3: 1159. 1883), raised to the rank of a genus by Post & Kuntze (Lex. Gen. Phan. 285. 1903) includes two species of the Mediterranean region, in which both florets are perfect and awned, and is probably not congeneric with Notholcus. *Ginannia* Bub. (Fl. Pyr. 4: 321. 1901) is a homonym, according to Dalle Torre and Harms (Gen. Siphon.) the name having been used by Scopoli (Introd. 300. 1777) and by Dietrich (Vollst. Lex. Gaertn. 4: 357. 1804).

1. **N. lanatus** Nash, n. comb. Velvet-grass. Plant grayish, velvety-pubescent; culms erect, 1 to 2 feet high; panicle 2 to 4 inches long, narrow, contracted, sometimes almost spike-like, purple-tinged; spikelets 2 lines long; glumes villous, hirsute on the nerves, the second broader than the first, 3-nerved; lemmas ciliate at the apex; awn of the second floret hook-like.

A native of Europe, occasionally cultivated as a meadow grass in the U. S. and abundantly introduced or escaped on the Pacific Coast, especially in the Coast Ranges.

Refs.—Notholcus lanatus Nash. *Holcus lanatus* L. Sp. Pl. 1048. 1753; Thurb. in Wats. Bot. Cal. 2: 299. 1880; Davy in Jepson, Fl. W. Mid. Cal. 49. 1901; Abrams, Fl. Los Ang. 38. 1904.

30. **AIRA** L.

Spikelets 2-flowered, both flowers perfect, articulated below the glumes, in open or contracted panicles. Glumes thin, somewhat scarious, subequal, acute, awnless, longer than the approximate florets. Lemmas bidentate, awned on the back, or the lower awnless. Palea a little shorter than the lemma. Delicate annuals. Species about 6, Europe and North Africa, introduced in the U. S. (An ancient Greek name used by Theophrastus for a weedy grass, probably Lolium temulentum.)

Awns of both florets 1½ to 2 lines long..............................1. *A. caryophyllea.*
Awn of lower floret minute or wanting..............................2. *A. capillaris.*

1. **A. caryophyllea** L. Culms solitary or few, slender, erect, 4 to 12 inches high; blades short, setaceous; panicle open, the silvery shining spikelets 1½ lines long, clustered toward the ends of the spreading capillary branches; lemma of both florets with a geniculate awn 2 lines long from below the middle, the teeth of the apex setaceous.

Introduced from Europe, common in open ground from Vancouver Island to southern California.

Refs. AIRA CARYOPHYLLEA L. Sp. Pl. 66. 1753; Davy in Jepson, Fl. W. Mid. Cal. 49. 1901.

2. **A. capillaris** Host. Similar to A. caryophyllea; panicle more diffuse; spikelets scattered at the ends of the branches, 1¼ lines long; lemma of lower floret awnless or with a minute awn just below the apex, the teeth short; lemma of upper floret bearing a geniculate awn 1½ lines long from below the middle, the teeth setaceous.

Sparingly introduced from Europe. Redwood Creek, Humboldt Co., *Davy & Blasdale* 5684; Kenwood, *Michener* 121.

Refs.—AIRA CAPILLARIS Host, Gram. Austr. 4: 20. pl. 35. 1809; Davy in Jepson, Fl. W. Mid. Cal. 50. 1901.

31. **DESCHAMPSIA** Beauv.

Spikelets 2 (rarely 3)-flowered, in narrow or open panicles. Glumes subequal, thin or scarious. Rachilla prolonged behind the upper floret as a hairy bristle. Lemmas 4-nerved (the midnerve becoming an awn), truncate, 2 to 4-toothed, bearing a slender dorsal awn from below the middle. Annuals or perennials, with shining spikelets.—Species about 20, in the cold and temperate regions of the world. (Loiseleur-Deslongchamps, a French botanist, 1774—1849.)

Plants annual; awns strongly geniculate.
  Glumes 3½ to 4 lines long.................................1. *D. danthonioides.*
  Glumes about 2 lines long.................................2. *D. gracilis.*
Plants perennial; awns straight.
  Panicle dense; plant stout.................................5. *D. holciformis.*
  Panicle loose or open.
    Plants robust; blades flat, 1 line wide or more; branches of panicle spreading.................................4. *D. caespitosa.*
    Plants slender; blades capillary; branches of panicle erect.................................3. *D. elongata.*

1. **D. danthonioides** Munro. Annual; culms slender, erect, 6 to 15 inches high; blades few, short and narrow; panicle open, 3 to 6 inches long, the branches capillary, stiffly ascending, naked below, bearing a few spikelets toward the ends; glumes 3 to 4 lines long, acuminate, smooth except the keel, longer than the florets; lemmas smooth and shining, somewhat indurated, 1 to 1½ lines long, the base of the florets and the rachilla pilose, the awns geniculate, 2 to 3 lines long.

Open ground throughout California except in the higher mountains; extends from Alaska to Mexico.

Refs.—DESCHAMPSIA DANTHONIOIDES Munro; Benth. Pl. Hartw. 342. 1857. *Aira danthonioides* Trin. Mém. Acad. St. Pétersb. VI. Math. Phys. Nat. 1: 57. 1830 (Jan., apparently earlier than Presl's work); Thurb. in Wats. Bot. Cal. 2: 298. 1880. *Danthonia calycina* Presl, Rel. Haenk. 1: 251. 1830, type from Monterey; Davy in Jepson, Fl. W. Mid. Cal. 51. 1901; Abrams, Fl. Los Ang. 39. 1904.

2. **D. gracilis** Vasey. Annual; culms 1 to 2 feet high; blades usually filiform; panicle open, 3 to 8 inches long, the branches slender, rather densely flowered toward the ends, naked below; glumes 2 to 3 lines long, the first 3-nerved; lemmas as in D. danthonioides.

Damp places; Mendocino Co. southward to Lower California. Sherwood, *Hitchcock* 2709; Tulare, *Davy* 3086, 3088, 3114; San Gabriel, *Hasse*; San Diego, *Brandegee* 3681, *Pringle* in 1882.

Refs.—DESCHAMPSIA GRACILIS Vasey, Bot. Gaz. 10: 224. 1885, type from San Diego, *Orcutt.*

3. **D. elongata** Munro. Perennial; culms slender, erect, 1 to 4 feet high;

blades flat, narrow, the basal cluster usually capillary; panicle narrow, as much as a foot long, the branches slender, appressed; glumes 2 to 3 lines long; lemmas 1 line long, similar to those of D. danthonioides, the awns shorter.

Open ground, common in the Coast Ranges south to Santa Cruz and in the lower Sierra Nevada, occasional in southern California; extends from Alaska to Arizona.

Refs.—Deschampsia elongata Munro; Benth. Pl. Hartw. 342. 1857; Davy in Jepson, Fl. W. Mid. Cal. 51. 1901. *Aira elongata* Hook. Fl. Bor. Am. 2: 243. pl. 288. 1840. *Deschampsia elongata* var. *ciliata* Vasey; Beal, Grasses N. Am. 2: 371. 1896; Davy in Jepson, Fl. W. Mid. Cal. 51. 1901. Var. *tenuis* Vasey; Davy in Jepson, Fl. W. Mid. Cal. 51. 1901, type from Santa Clara Co., *Davy* 213.

4. **D. caespitosa** Beauv. Perennial; culms erect, 2 to 4 feet high; sheaths smooth; blades flat or folded, scabrous above; panicle loose, drooping, 4 to 8 inches long, the slender scabrous branches spikelet-bearing toward the ends; spikelet 2 lines long, the florets distant, the rachilla ½ the length of the lower sessile floret; lemmas smooth, erose-truncate; awn from near the base, but little longer than the lemma, straight, articulated at the base, deciduous.

Common in mountain meadows and bogs in the Sierra Nevada and in the high mountains of southern California. The only specimens seen from the Coast Ranges are: Sherwood, *Davy & Blasdale* 5180, 5181. Northern regions of the northern hemisphere and southward in the mountains to Mexico.

[illegible] 1812. *Aira* [illegible] *Deschampsia* [illegible]

5. **D. holciformis** Presl. Perennial; culms [illegible] 2 to 4 feet high, rather stout; blades tightly folded, or involute, firm, mostly basal, smooth or somewhat scabrous especially toward the tip, the cauline blades short; ligule 2 to 3 lines long; panicle narrow, rather dense, mostly dark or bronze-color, 6 to 8 inches long.

Sandy [illegible] and moist places near the coast, from Del Norte to Monterey Co.

[illegible] Pt. [illegible]

Refs.—Deschampsia holciformis Presl, Rel. Haenk. 1: 251. 1830; Davy in Jepson, Fl. W. Mid. Cal. [illegible] Wats. Bot. Cal. 2: 297. 1880.

32. TRISETUM Pers.

Spikelets 2 (rarely 3 to 5)-flowered, in narrow or open panicles. Glumes unequal, the second about as long as the florets, keeled, the first 1-nerved, the second 3-nerved. Rachilla prolonged behind the upper floret as a hairy bristle or pedicel. Lemmas membranaceous, keeled, 2-toothed at the apex (teeth often aristate), bearing a slender dorsal awn. Palea narrow, 2-toothed. Tufted perennials.—Species about 50, arctic and temperate regions and the high mountains of the tropics. (Latin tres, three, and seta, bristle, the lemma often being 2-awned from the apex, and 1-awned from the back.)

Awn included or wanting ....1. *T. brandegei.*
Awn exserted.
  Panicle loose, open, the branches naked at base ....2. *T. cernuum.*

Panicle narrow or compact.
  Panicle narrow but loose; blades flat, usually 2½ to 5 lines wide. . . . .3. *T. canescens.*
  Panicle spike-like.
    Sheaths pubescent . . . . .4. *T. spicatum.*
    Sheaths glabrous . . . . .5. *T. congdoni.*

1. **T. brandegei** Scribn. Culms smooth, erect, 1 to 2 feet high; sheaths smooth or sparsely retrose-pilose; blades flat, erect, 1 to 2 lines wide, scabrous or more or less pilose; panicle narrow, usually spike-like, 2 to 4 inches long; glumes about 3 lines long, scabrous on the keel, subequal, the first 1-nerved or obscurely 3-nerved, the second 3 nerved; lemmas scaberulous, the lower 2 lines long, the awn reduced to a bristle scarcely reaching the tip, or on the upper lemma obsolete, the teeth acute, not aristate.

Mountain meadows in the Sierra Nevada; also in the Cascades of Oregon (the type).

Locs.—Mt. Tallac, *Hitchcock* 3147, 3148; Shadow Lake Trail, *Congdon* in 1899; Long Meadow, Tuolumne Co., *Hitchcock* 3261; Kings River, *Brewer* 2822a.

Refs.—TRISETUM BRANDEGEI Scribn. Bull. Torr. Club 10: 64. 1883. *T. subspicatum* Beauv. var. *muticum* Boland.; Thurb. in Wats. Bot. Cal. 2: 296. 1880, type from the upper Tuolumne, *Bolander* 5019. *T. muticum* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 50. 1898.

2. **T. cernuum** Trin. Culms rather lax, 2 to 4 feet high; sheaths smooth; blades thin, flat, lax, scabrous, 3 to 6 lines wide; panicle open, lax or drooping, 6 to 12 inches long, the branches verticillate, slender, flexuous, spikelet-bearing toward the ends; spikelet ¼ to ½ inch long, with usually 3 distant florets, the first longer than the second glume; glumes very unequal, the first narrow, acuminate, 1-nerved, ½ line long, the second broad, 3-nerved, 1½ to 2 lines long; lemmas with setaceous teeth, the awns about as in T. canescens.

Moist woods, Alaska to Montana and northern California: Humboldt Bay, *Chandler* 1176; Mendocino Co., *Bolander* 4758, 6122, *Brown* 764.

Refs.—TRISETUM CERNUUM Trin. Mém. Acad. St. Pétersb. VI. Math. Phys. Nat. 1: 61. (Jan.) 1830; Thurb. in Wats. Bot. Cal. 2: 295. 1880; Davy in Jepson, Fl. W. Mid. Cal. 52. 1901. *Avena nutkaensis* Presl, Rel. Haenk. 1: 254. 1830. *Trisetum nutkaense* Scribn. & Merr.; Davy, Univ. Cal. Publ. Bot. 63. 1902; Davy in Jepson, Fl. W. Mid. Cal. ed. 2. 55. 1911.

3. **T. canescens** Buckl. Culms erect, or decumbent at base, 2 to 4 feet high; sheaths more or less retrose pilose, at least the lower, and often also canescent; blades flat, scabrous or canescent; panicle narrow, loose, sometimes interrupted and spike-like, 4 to 8 inches long; glumes smooth, except the keel, strongly unequal, the first narrow, acuminate, 1-nerved, the second broad, acute, 3-nerved, longer than the first, 2½ to 3½ lines long; lemmas firm, scaberulous, the upper exceeding the glumes, the teeth aristate; awns geniculate, spreading exserted, more or less twisted below, attached ⅓ below the apex, usually about ½ inch long.

Mountain meadows, moist ravines, and along streams: Coast Ranges south to Santa Cruz, and Sierra Nevada south to Tulare Co.; north to Vancouver Island, east to Montana and New Mexico. Two specimens have a more condensed panicle than usual (Mt. Tamalpais, *Davy* 139; Mendocino Co., *Bolander* 4744).

Refs.—TRISETUM CANESCENS Buckl. Proc. Acad. Phila. 1862: 100. 1863; Thurb. in Wats. Bot. Cal. 2: 296. 1880; Davy in Jepson, Fl. W. Mid. Cal. 52. 1901.

T. CHROMOSTACHYUM Desv. from Chile is a closely allied species with acuminate awned glumes and shorter pedicels.

4. **T. spicatum** Richter. Culms erect, rather stout, 6 to 18 inches high,

smooth or puberulent; sheaths and usually the blades puberulent; panicle dense and spike like, pale or often dark purple, 2 to 6 inches long; spikelets 2 to 3 lines long; glumes somewhat unequal in length, smooth except the keels, the first narrow, acuminate, 1-nerved, the second broader, 3-nerved, acute; lemmas scaberulous, 2½ lines long, the first longer than the glumes, the teeth setaceous; awns geniculate, exserted.

A characteristic grass of high altitudes in the Sierra Nevada, especially above timber-line, found up to the limit of vegetation; extends from arctic regions of the northern hemisphere southward in the higher mountains to the southern hemisphere.

Refs.—TRISETUM SPICATUM Richter, Pl. Eur. 1: 59. 1890. *Aira spicata* L. Sp. Pl. 64. 1753. *Trisetum subspicatum* Beauv. Ess. Agrost. 88. 1812; Thurb. in Wats. Bot. Cal. 2: 296. 1880. *Aira subspicata* L. Syst. Veg. ed. 10. 2: 873. 1759. *Trisetum subspicatum* Beauv. var. *molle* Gray, Man. ed. 2. 572. 1856; Thurb. in Wats. Bot. Cal. 2: 296. 1880.

5. **T. congdoni** Scribn. & Merr. Resembling T. spicatum, but differing in having smooth sheaths and blades, the latter usually flat but sometimes involute, and in having wider panicles and larger spikelets, about 4 lines long.

Meadows and slopes above timber-line, Sierra Nevada.

Locs.—Mt. Shasta, *Copeland* 3895, *Hitchcock* 2935; Donner Pass, *Heller* 7117; Lake Tahoe, *Hall & Chandler* 4676; Pyramid Peak, *Hall & Chandler* 4715; Yosemite Nat. Park, *Hitchcock* 3260, 3270, 3271, 3312; Sequoia Nat. Park, *Coville & Funston* 1495, *Grant* 5339, *Hall & Babcock* 5512, 5678, *Hitchcock* 3390, *Purpus* 5116.

Ref.—TRISETUM CONGDONI Scribn. & Merr. Bull. Torr. Club 29: 470. 1902, type from Shadow Lake Trail, *Congdon* in 1899.

33. SPHENOPHOLIS Scribn.

Spikelets 2 to 3-flowered, articulated below the glumes, in narrow panicles. Glumes about equal in length, often dissimilar in shape, the first narrow, the second often obovate, becoming subcoriaceous in fruit, 3-nerved. Rachilla prolonged behind the uppermost floret as a slender pedicel. Lemma chartaceous, awnless or awned below the summit, the nerves obscure. Slender perennials.—Species about 6, all North American. (Greek sphen, a wedge, and pholis, a scale.)

1. **S. obtusata** Scribn. var. **lobata** Scribn. Culms erect, 1 to 2 feet high; sheaths and blades scabrous; panicle narrow and compact, often spike-like, more or less interrupted or lobed especially near base, 2 to 4 inches long; glumes subequal, the second subcucullate, the broad chartaceous margins smooth and shining.

Prairies and open woods throughout U. S. and extending into Canada and Mexico. Rare in California.

Locs.—Amador Co., *Hansen* 615; Santa Ana River, *Parish Bros.* 1640; San Bernardino, *Parish* in 1891; Murray Cañon, *Wilder* 1128.

Refs.—SPHENOPHOLIS OBTUSATA Scribn. var. LOBATA Scribn. Rhodora 8: 144. 1906. *Trisetum lobatum* Trin. Mém. Acad. St. Pétersb. VI. Math. Phys. Nat. 1: 66. 1830. *Eatonia obtusata* Gray, Man. ed. 2. 558. 1856; Thurb. in Wats. Bot. Cal. 2: 302. 1880. *Eatonia* Raf. is a synonym of Panicum.

34. KOELERIA Pers.

Spikelets 2 to 4-flowered, in narrow spike-like panicles. Glumes unequal, slightly shorter than the florets, membranaceous, acute, the first 1-nerved, the second 3-nerved. Rachilla prolonged behind the uppermost floret as a naked pedicel. Lemmas chartaceous-membranaceous, the margins scarious, faintly 3 to 5-nerved, acute or mucronate or awned. Tufted annuals or perennials.—Species about 50, temperate regions, mostly of the Old World. (Prof. G. L. Koeler, an early writer on grasses.)

Plants annual; culm glabrous below panicle..........................1. *K. phleoides.*
Plants perennial; culm puberulent below panicle.........................2. *K. cristata.*

1. **K. phleoides** Pers. Annual; culms 6 to 12 inches high, smooth throughout; panicle close and spike-like, 1 to 3 inches long, obtuse; spikelets 1 to 2 lines long; glumes smooth, acute, the first narrower; lemmas smooth, short-awned from a bifid apex.

Introduced from Europe. Lassen Peak, *Austin* in 1882; Butte Co., *Heller* 5534; Lathrop, *Congdon* in 1896.

Refs. KOELERIA PHLEOIDES Pers. Syn. Pl. 1: 97. 1805. *Festuca phleoides* Vill. Fl. Delph. 2: 95. 1787.

2. **K. cristata** Pers. Perennial; culms erect, 1 to 2 feet high, glabrous below, puberulent below panicle; sheaths pubescent, at least the lower; blades mostly basal, rather short; panicle compact, spike-like, pointed, 2 to 4 inches long, often interrupted at base; spikelets 2 to 2½ lines long; glumes and lemmas scabrous.

Prairies and open woods, mostly in the Coast Ranges and in the southern mountains; extends throughout the cooler parts of the northern hemisphere.

Var. **longifolia** Vasey. Differs in being taller, and in having longer blades, the basal as much as a foot long, and larger and looser panicles.—Open woods in the Coast Ranges.

Refs.—KOELERIA CRISTATA Pers. Syn. Pl. 1: 97. 1805; Thurb. in Wats. Bot. Cal. 2: 301. 1880; Davy in Jepson, Fl. W. Mid. Cal. 61. 1901; Abrams, Fl. Los Ang. 45. 1904. *Aira cristata* L. Sp. Pl. 63. 1753. *Koeleria cristata* Pers. var. *pubescens* Vasey; Davy in Jepson, Fl. W. Mid. Cal. 61. 1901. . Var. *pinetorum* Abrams, Fl. Los Ang. 46. 1904. Var. LONGIFOLIA Vasey; Davy in Jepson, Fl. W. Mid. Cal. 61. 1901, type from Santa Cruz, *Anderson*,

In a recent monograph of the genus Koeleria by Domin (Bibl. Bot. Heft. 65. 1907), the California specimens are referred as follows: *K. gracilis* Pers., *Bolander* 1531, *Hall* 1342. *K. gracilis* var. *glabra* Domin subvar. *genuina* Domin, San Diego, *Vasey*. *K. gracilis* var. *genuina* subvar. *supertusa* Domin, *Heller* 6814. *K. pseudocristata* Domin forma *densevestita* Domin, *Hall* 2206. *K. pseudocristata* forma *laxa* Domin, *Heller* 7443. *K. polyantha* Domin var. *californiensis* Domin, *Hall* 2131. *K. nitida* Nutt. var. *typica* Domin forma *glabra* Domin, San Diego, *Orcutt* in 1884, S. E. Calif. *Palmer* in 1876. *K. nitida* var. *typica* forma *pubescens* Domin, Thomas Meadows, *Hall* in 1901. *K. nitida* var. *californica* Domin, San Diego, *Pringle* in 1882. *K. nitida* var. *californica* subvar. *transiens* Domin, San Diego, *Brandegee* in 1903, *Baker* 3678. *K. nitida* var. *californica* subvar. *multiflora* Domin, San Bernardino Mts., *Parish Bros.* 855. *K. nitida* var. *californica* subvar. *vestita* Domin, "Cusamacca Mts.," *Palmer* in 1875.

35. AVENA L.

Spikelets 2 to 6-flowered, in open panicles. Rachilla bearded below the florets. Glumes subequal, membranaceous, many-nerved, longer than the lemmas and usually exceeding the uppermost floret. Lemmas indurated except toward the summit, 5 to 9-nerved, bidentate at apex, bearing a long dorsal twisted awn (often straight or wanting in cultivated forms). Annuals or perennials with large spikelets.—Species about 50 in the temperate and cooler regions of the world, the California species all annuals, introduced from Europe. (The classical Latin name.)

Lemmas glabrous or nearly so.
  Spikelets usually 2-flowered; awn usually wanting, or if present weakly geniculate....... 2. *A. sativa.*
  Spikelets usually 3-flowered; awn present, strongly geniculate ...1. *A. fatua* var. *glabrata.*
Lemmas pubescent with long, usually brown hairs.
  Teeth of lemmas acute not awned..................................1. *A. fatua.*
  Teeth of lemmas awned...3. *A. barbata.*

1. **A. fatua** L. WILD OAT. Culms 1 to 3 feet high, erect, stout; panicle loose and open, the slender branches usually horizontally spreading; spikelets usually 3-flowered; glumes about 1 inch long; rachilla and lower part of the shining lemma clothed with long stiff brownish hairs; florets readily falling from the glumes; lemma nerved above, about 10 lines long, the teeth acuminate but not awned; awn stout, geniculate, red-brown, twisted below, about 1½ inches long.

A native of Europe, a common weed on the Pacific Coast. Fields and waste places, especially in southern California.

Var. **glabrata** Peterm. Differs in having nearly or quite glabrous lemmas.—Introduced from Europe, in similar situations with the species.

Refs.—AVENA FATUA L. Sp. Pl. 80. 1753; Thurb. in Wats. Bot. Cal. 2: 295. 1880; Davy in Jepson, Fl. W. Mid. Cal. 53. 1901; Abrams, Fl. Los Ang. 39. 1904. Var. GLABRATA Peterm. Fl. Bein. 13. 1841. Var. *glabrescens* Coss. Fl. Alg. 113. 1867; Davy in Jepson, Fl. W. Mid. Cal. 53. 1901; Abrams, Fl. Los Ang. 40. 1904.

2. **A. sativa** L. CULTIVATED OAT. Similar to A. fatua; florets not readily separating from the glumes; spikelets usually 2-flowered; lemma glabrous; awn straight, often wanting.

Commonly cultivated and occasionally escaped.

Refs.—AVENA SATIVA L. Sp. Pl. 79. 1753; Davy in Jepson, Fl. W. Mid. Cal. 54. 1901.

3. **A. barbata** Brot. Similar to A. fatua; spikelets somewhat smaller, mostly 2-flowered, the pedicels curved and capillary; lemma clothed with stiff red hairs, the teeth acuminate and ending in fine awns 2 lines long.

A native of Europe, introduced on the Pacific Coast; a common weed in fields and waste places.

Refs.—AVENA BARBATA Brot. Fl. Lusit. 1: 108. 1804; Davy in Jepson, Fl. W. Mid. Cal. 54. 1901.

ARRHENATHERUM ELATIUS Beauv. Tall Oat Grass. This has been collected at Agricultural Station, Amador Co., by Hansen (no. 1737) and in the Berkeley Hills by Davy. It is a native of Europe, often cultivated in the Eastern States as a meadow grass and frequently escaped along roadsides and into waste places. As yet it appears to be rare in California. It can be recognized by the 2-flowered spikelet, the upper perfect and awnless or nearly so, and the lower staminate and dorsally awned. A tall perennial with flat blades and long narrow panicles. (See also Davy in Jepson, Fl. W. Mid. Cal. 54. 1901.)

36. DANTHONIA DC.

Spikelets several-flowered, in narrow or open panicles, the uppermost floret reduced. Glumes 2, subequal, much longer than the lemmas and usually exceeding the uppermost floret. Lemmas convex, 2-toothed at apex, with a twisted awn from between the teeth, the awn flat, formed by the extension of the 3 middle nerves of the lemma. Tufted perennials with numerous basal innovations and few-flowered simple panicles.—Species about 100 in the temperate and warmer region of both hemispheres, only about 8 in North America. (Étienne Danthoine, a French botanist.)

Sheaths pubescent.
  Spikelets 2 to 4 . . . . .1. *D. americana.*
  Spikelets solitary . . . . .2. *D. unispicata.*
Sheaths glabrous.
  Spikelets on spreading pedicels . . . . .3. *D. californica.*
  Spikelets on short erect pedicels, forming a narrow spike-like panicle.....4. *D. intermedia.*

1. **D. americana** Scribn. Culms 1 to 2 feet high, smooth, tending to disarticulate at the nodes; sheaths pilose; blades short, flat, or those of the innovations involute; panicle bearing 2 to 5 spikelets, the pedicels usually about ½ inch long, spreading or somewhat reflexed; glumes ½ to ¾ inch long, smooth, acuminate, about 7-nerved; lemmas 2½ to 3½ lines long, smooth and convex on the back, pilose at base and margins, broad, abruptly contracted into 2 teeth with awns 1 to 3 lines long, the dorsal awn from between these teeth, geniculate, flat and twisted below, straight and divergent above, exserted.

Wet meadows and moist places in rocks, British Columbia to Wyoming, south to the San Bernardino Mts. Also in Chile.

Locs.—Siskiyou Co., *Butler* 1660; Humboldt Co., *Chandler* 1239; Mt. Tallac, *Hitchcock* 3158; Lake Tahoe, *Reed & Pendleton* 1776; San Francisco, *Davy* 4211; Crystal Springs Lake, *Elmer* 4707; Monterey, *Davy* 7237 in part, 7260; Kaweah Meadows, *Purpus* 5247; San Bernardino Mts., *Davidson* 2319, *Parish* 3295.

Refs.—DANTHONIA AMERICANA Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 30: 5. 1901, based on *D. grandiflora* Phil. (1873) from Chile, not Hochst. (1851). *Merathrepta americana* Piper, Contr. Nat. Herb. 11: 123. 1906. Piper assumes that the type species of Danthonia DC. is *D. decumbens*, which is not congeneric with *D. spicata* and its allies. I believe, however, that *D. spicata* should be taken as the type of Danthonia, in which case the latter name is retained for the California species.

2. **D. unispicata** Munro. Culms short, 6 to 8 inches high, about as long as the numerous basal leaves; sheaths and blades pilose; panicle reduced to a single spikelet, the pedicel about ½ inch long, flexuous, pubescent above, the joint at base bearing 1 or 2 bracts; spikelets about as in D. americana, the lemma more gradually acuminate into awns.

Rocky hills, Modoc and Lassen cos., and from Oregon to Wyoming.

Locs.—Modoc Co., *Baker & Nutting* in 1894; Egg Lake, *Davy;* Loon Valley, *Davy;* Red Clover Valley, *Heller & Kennedy* 8705.

Refs.—DANTHONIA UNISPICATA Munro; Thurb. in Wats. Bot. Cal. 2: 294. 1880, as synonym under *D. californica* Boland. var. *unispicata* Thurb. in Wats. Bot. Cal. 2: 294. 1880.

3. **D. californica** Boland. Resembles D. americana; culms 2 to 3 feet tall; sheaths smooth or somewhat pilose at the throat; blades scabrous above, longer, especially those of the less numerous innovations; teeth of lemma more gradually acuminate.

Dry hills, Coast Ranges as far as San Luis Obispo, apparently rare in the Sierra Nevada; extends north to British Columbia and east to Montana and Colorado.

Locs.—Ukiah, *Davy & Blasdale* 5056; Mendocino Co., *McMurphy* 405; Sherwood, *Hitchcock* 2693, 2727; Lovelock, *Leiberg* 5058; Mt. Tamalpais, *Chase* 5675, *Piper* 6313; San Francisco, *Bolander* 1533; Monterey, *Elmer* 3306; Pacific Grove, *Heller* 6647; Yosemite Valley, *Hitchcock;* San Luis Obispo, *Jones* 3248.

Refs.—DANTHONIA CALIFORNICA Boland. Proc. Cal. Acad. 2: 182. 1863, type from vicinity of San Francisco, *Bolander;* Thurb. in Wats. Bot. Cal. 2: 294. 1880; Davy in Jepson, Fl. W. Mid. Cal. 55. 1901; Abrams, Fl. Los Ang. 40. 1904.

4. **D. intermedia** Vasey. Culms 6 to 15 inches high; sheaths smooth; blades becoming involute, more or less pilose; panicle narrow, compact, often 1-sided, 1 to 2 inches long, the pedicels short and appressed; glumes about ½ inch long; lemmas similar to those of D. americana, the teeth more gradually acuminate, the awns shorter, the dorsal awn flat, tightly twisted below, slightly twisted above.

Mountain meadows in the high Sierra Nevada; extends from British Columbia to Quebec and south to New Mexico.

Locs.—Mt. Tallac, *Hitchcock* 3144; Yosemite Nat. Park, Ostrander's, *Bolander* 6104;

Tuolumne River, *Lemmon*; Lyell Fork, *Hitchcock* 3286; Sequoia Nat. Park, Crabtree Meadow, *Hitchcock* 3440, Little Kern, *Hitchcock* 3469.

Refs.—DANTHONIA INTERMEDIA Vasey, Bull. Torr. Club 10: 52. 1883. *D. sericea* [Nutt. misapplied by] Thurb. in Wats. Bot. Cal. 2: 294. 1880.

TRIBE VII. CHLORIDEAE.

37. **CYNODON** Rich.

Spikelets 1-flowered, compressed, awnless, sessile in 2 rows along 1 side of a continuous rachis. Glumes unequal, narrow, acute, keeled. Rachilla prolonged behind the floret as a blunt pedicel. Lemma broad, boat-shaped, obtuse, ciliate on the keel. Palea as long as lemma, the prominent keels close together, ciliolate. Low perennials with creeping rhizomes or stolons, and slender digitate unilateral spikes.—Species 4, warm regions. (Greek kuon, a dog, and odous, a tooth.)

1. **C. dactylon** Pers. BERMUDA GRASS. Culms flattened, wiry, glabrous; ligule a conspicuous ring of white hairs; spikes 4 or 5, 1 to 2½ inches long; spikelets imbricated, 1 line long, the lemma longer than the glumes.

A native of the warmer parts of the Old World, now widely cultivated in the western hemisphere from Virginia to Argentina. Not uncommon in California, especially along irrigating ditches; from Sacramento (*Michener* 147) and Calaveras Co. (*Davy* 1458) south to Santa Catalina Island (*Trask*) and Yuma Res. (*Chase* 5516). Abundantly escaped in the southern part of the U. S.

Refs.—CYNODON DACTYLON Pers. Syn. 1: 85. 1805; Thurb. in Wats. Bot. Cal. 2: 292. 1880; Davy in Jepson, Fl. W. Mid. Cal. 56. 1901; Abrams, Fl. Los Ang. 41. 1904. *Panicum dactylon* L. Sp. Pl. 58. 1753. *Capriola dactylon* Kuntze, Rev. Gen. Pl. 2: 764. 1891.

38. **SPARTINA** Schreb.

Spikelets 1-flowered, laterally compressed, articulated below the glumes, sessile and closely imbricated in 2 rows on 1 side of a continuous rachis, the unilateral spikes scattered along a common axis. Glumes unequal, keeled, acute or bristle-pointed. Lemma thin, obtuse, 1-nerved, usually shorter than the second glume. Palea equaling or exceeding the lemma. Coarse perennials with strong rhizomes, rigid culms and long tough blades.—Species about 10, mostly maritime, in temperate regions of Europe and America. (Greek spartine, a cord, referring to the tough leaves.)

Spikes closely approximate, forming a cylindrical inflorescence; glumes smooth; blades wide, flat below ....1. *S. foliosa.*
Spikes distinct; glumes ciliate; blades narrow and soon involute..............2. *S. gracilis.*

1. **S. foliosa** Trin. Culms stout, as much as ½ inch thick at base, usually rooting from the lower nodes, 1 to 4 feet high, somewhat spongy in texture; blades 4 to 6 lines broad at the flat base, gradually narrowed to a long involute tip, smooth on surface and margin; inflorescence dense, spike-like, about 6 inches long; spikes approximate, numerous, close-appressed, 1 to 2 inches long; spikelets indurated, very flat, about ½ inch long; glumes ciliate on keel, acute but not awned, the first narrow, about ⅔ as long as second, smooth, the second sparingly hispidulous and striate-nerved; lemma hispidulous on sides, smooth on keel, a little shorter than the second glume; palea thin, longer than the lemma, 1-keeled, 2-nerved.

Salt marshes along the coast from San Francisco Bay southward. Useful in reclaiming marsh land.

Locs.—Reclamation, *Eastwood* in 1897; Oakland, *Blankinship* 18; San Francisco, *Bioletti* 124, *Bolander* 1556; Newport, *Parish Bros.* 1602; San Diego, *Orcutt* 569, *Palmer* 274 in 1888.

Refs.—SPARTINA FOLIOSA Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4^1: 114. 1840, type from California (without collector or locality); Davy in Jepson, Fl. W. Mid. Cal. ed. 2. 58. 1911; Abrams, Fl. Los Ang. 42. 1904. *S. stricta* [Roth, misapplied by] Thurb. in Wats. Bot. Cal. 2: 290. 1880. Var. *glabra* [Muhl. misapplied by] Davy in Jepson, Fl. W. Mid. Cal. 56. 1901.

S. GLABRA Muhl. is said to grow at Wilmington (Abrams, Fl. Los Ang. 42. 1904).

2. **S. gracilis** Trin. Culms 2 to 3 feet high; blades flat, becoming involute, 6 to 8 inches long, very scabrous above; spikes few, 4 to 8, closely appressed to the axis, ¾ to 1 inch long; spikelets much flattened laterally, about 3 lines long; glumes smooth, except the ciliate keel, 1-nerved, acute but not awned, the first about ½ as long as the second; lemma about as long as second glume, ciliate on keel; palea as long as lemma, obtuse, 2-nerved, but compressed-keeled between the nerves.

Alkaline meadows, Washington to Saskatchewan, south to eastern California (Inyo Co., *Coville & Funston* 1002) and Arizona.

Refs.—SPARTINA GRACILIS Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4^1: 110. 1840; Thurb. in Wats. Bot. Cal. 2: 290. 1880.

39. CHLORIS Swartz.

Spikelets with 1 perfect flower, sessile in 2 rows along 1 side of a continuous rachis. Glumes 2, unequal, narrow, acute, keeled. Rachilla prolonged behind the fertile floret, bearing 1 or more rudimentary awned sterile lemmas. Lemma 1 to 3-nerved, often ciliate on the back or margins, the midnerve usually prolonged into a slender awn. Usually perennial grasses with flat blades, compressed sheaths, and digitate unilateral spikes.—Species about 40, in the warmer regions of the world. (Latin Chloris, the goddess of flowers.)

1. **C. elegans** H.B.K. Annual; culms erect or spreading, 1 to 3 feet high, smooth; sheaths smooth, much compressed, especially the basal, the uppermost often inflated around the base of the inflorescence; spikes several, 6 to 12, pale or dark-colored, 1 to 3 inches long; spikelets imbricated, the glumes persistent on the rachis after the falling of the florets; glumes 1-nerved, the second about 1½ lines long, awn-pointed; lemma somewhat fusiform, about 1 line long, 3-nerved, short-pilose at base and along the lower half of the keel, long-pilose on the margins near the apex, with a slender straight awn about 5 lines long, from just below apex; rudiment reaching about to tip of fertile floret, truncate, the awn somewhat shorter.

Fields and waste places, southern California to Texas and Mexico.

Locs.—Riverside, *Reed* (Parish, Bull. S. Cal. Acad. 8: 7. 1909); Ft. Yuma, *Newberry;* Colorado River, *Schellenger.*

Ref.—CHLORIS ELEGANS H.B.K. Nov. Gen. & Sp. 1: 166. 1816.

SCHEDONNARDUS PANICULATUS Trelease; Branner & Coville, Rep. Geol. Surv. Ark. 1888^4: 236. 1891. *Lepturus paniculatus* Nutt. Gen. 1: 81. 1818; Thurb. in Wats. Bot. Cal. 2: 322. 1880. This species is found on the Great Plains from Canada to northern Mexico and as far west as New Mexico, but probably does not occur in California. Thurber (l. c.) gives one locality in the latter state, "Monterey (Dr. Canfield)," and in the Gray Herbarium are two specimens labeled "California Nuttall."

40. BOUTELOUA Lag.

Spikelets with 1 perfect flower, sessile in 2 rows along 1 side of a flat rachis, the latter usually projecting beyond the spikelets. Glumes unequal, keeled.

Rachilla prolonged beyond the perfect floret and bearing a sterile (rarely staminate) floret, a second or third rudiment often present. Lemma broader, 3 to 5-nerved, 2 to 4-toothed or cleft, usually awned between the teeth. Palea about as long as the lemma, bidentate, the 2 keels seabrous. Sterile floret sometimes reduced to awns, rarely obsolete. Annuals or usually perennials with narrow blades and few or numerous short spikes scattered along a common axis.—Species about 30, all American, mostly of the Mexican plateau. (The brothers Claudio and Esteban Boutelou, Spanish gardeners.)

Spikes containing 1 to 3 spikelets, numerous along a main axis.
  Plants perennial . . . . 1. *B. curtipendula.*
  Plants annual . . . . 2. *B. aristidoides.*
Spikes usually few, containing numerous spikelets.
  Plants annual.
    Awns about 1½ lines long; spikes 2 to 4 . . . . 3. *B. arenosa.*
    Awns barely protruding; spikes 4 to 6 or more . . . . 4. *B. barbata.*
  Plants perennial.
    Spikes several.
      Spikes narrow, strictly 1-sided; spikelets numerous. . . . . 5. *B. rothrockii.*
      Spikes broad, loose, irregularly 1-sided; spikelets few. . . . . 6. *B. radicosa.*
    Spikes usually 1 to 3.
      Rachis not prominently produced; glumes sparsely hairy. . . . . 7. *B. gracilis.*
      Rachis produced beyond the spikelets as a naked point; glumes prominently papillose-hispid . . . . 8. *B. hirsuta.*

1. **B. curtipendula** Torr. Perennial; culms erect, 1 to 4 feet high; spikes numerous on an elongated rachis, ¼ to ¾ inch long, reflexed, mostly turned to one side; glumes narrow, acuminate, scabrous on keel and somewhat so on the back, the second about 2½ lines long; lemma as long as second glume, ovate-lanceolate, 3-nerved, scabrous toward tip, 3-toothed, the palea about as long; rudiment as long as lemma, 4-lobed, 3-awned between the lobes, the lateral lobes and awns shorter.

Plains and rocky hills, Montana and Ontario, south to Mexico.

Loc.—Santa Rosa Mt., San Jacinto Range, *Hall* 2138.

Refs.—BOUTELOUA CURTIPENDULA Torr. in Emory, Mil. Reconn. 154. 1848. *Chloris curtipendula* Michx. Fl. Bor. Am. 1: 59. 1803. *Bouteloua racemosa* Lag. Var. Cienc. 2^4: 141. 1805.

2. **B. aristidoides** (Griseb. Annual; culms spreading, slender, 6 to 15 inches high; spikes several, slender, about ½ inch long, the 1 to 3 spikelets distant, appressed to the rachis, the latter ending in a slender naked point; glumes narrow, acuminate, the first ½ as long as the second; lemma narrowly lanceolate, 3-nerved, the nerves pilose, the lateral ending in awned teeth as long as the central acuminate point; rudiment consisting of a pilose pedicel and 3 awns longer than the spikelet.

Open ground, deserts and foothills, southern California to western Texas and south into South America. San Diego, *Orcutt* in 1890; Colorado Desert, *Brandegee* in 1905; Colorado River, Riverside Co., *Hall* 5962.

Refs.—BOUTELOUA ARISTIDOIDES Griseb. Fl. Brit. W. Ind. 537. 1864; Thurb. in Wats. Bot. Cal. 2: 291. 1880. *Dinebra aristidoides* H.B.K. Nov. Gen. & Sp. 1: 171. 1816.

3. **B. arenosa** Vasey. Annual; culms spreading or prostrate, about 6 inches long; spikes 2 to 4, many-flowered, about ½ inch long; glumes 1-nerved, the first 1 line, the second 1½ lines long; lemma a little shorter than the second glume, pilose below, 4-lobed, the lateral lobes short, 3-awned from between the lobes, the awns about 1½ lines long; palea 4-toothed, 2-awned; rudiment ½ line long, triangular-truncate, pilose at base, 4-lobed, with 3 long awns between the lobes.

Loose sandy soil, deserts of northern Mexico, extending sparingly into the adjoining U. S. Cargo Muchacho, Colorado Desert, *Orcutt*.

Ref.—Bouteloua arenosa Vasey, U. S. Dept. Agr. Div. Bot. Bull. 12^{1}: 34. 1890.

4. **B. barbata** Lag. Annual; culms spreading or prostrate, 6 to 12 inches long; spikes several, usually 4 to 6, about ½ to ¾ inch long; spikelets numerous, imbricated; glumes unequal, scabrous on keel and somewhat so on back, awn pointed from a toothed apex, the second twice as long as the first, 1½ lines long; lemma pilose below, 3-awned, the central between the obtuse scabrous lobes; rudiment pilose at base, 2-lobed, 3-awned, enclosing an orbicular scale; awns of spikelet about 1 line long.

Deserts, Utah to southern California (The Needles, *Jones* 67a in 1884) and south into Mexico.

Refs.—Bouteloua barbata Lag. Var. Cienc. 2^{4}: 141. 1805. *B. polystachya* Torr. U. S. Rep. Expl. Miss. Pacif. 5: 366. 1857; Thurb. in Wats. Bot. Cal. 2: 291. 1880. *Chondrosium polystachya* Benth. Bot. Voy. Sulph. 56. 1844.

5. **B. rothrockii** Vasey. Perennial; culms erect or spreading, 1 to 2 feet high; spikes several, usually 4 to 6, ½ to 1 inch long; spikelets numerous, imbricated; glumes unequal, scabrous on keel and back, cuspidate and 2-toothed at apex, the second 1¼ lines long, about twice as long as the first; lemma pilose below, 4-lobed, 3-awned, the awns equal, 1¼ lines long; rudiment pilose at base, consisting of 2 short truncate lobes, 3 equal awns about 1 line long and an included orbicular scale.

Mesas and foothills, Utah to southern California (Jamacha, *Canby*) and Mexico.

Ref.—Bouteloua rothrockii Vasey, Contr. Nat. Herb. 1: 268. 1893.

6. **B. radicosa** Griff. Perennial; culms 6 inches to 2 feet high, erect; blades mostly basal, flat; spikes several to many, ¾ to 1 inch long, irregularly 1-sided; glumes somewhat unequal, rather broad, the second about 3 lines long; lemma smooth, bearing 3 short awns; rudiment lanceolate, with 3 long awns.

Upper foothills and mountains, southern California (*Orcutt* in 1884) and New Mexico to Mexico.

Refs.—Bouteloua radicosa Griff. Contr. Nat. Herb. 14: 411. 1912. *Atheropogon radicosus* Fourn. Mex. Pl. 2: 140. 1886. *Dinebra bromoides* H.B.K. Nov. Gen. & Sp. 1: 172. 1816, not *Bouteloua bromoides* Lag.

7. **B. gracilis** Lag. Perennial; culms erect, 6 inches to 1½ feet high; sheaths and blades glabrous; spikes 1 to 3, 1 to 2 inches long, usually a little curved, the rachis not produced; spikelets 2½ to 3 lines long, densely crowded, pectinate; glumes narrow, the first about ½ as long as the second, the latter sparsely papillose pilose on the keel; lemma pilose, 3-cleft, the lateral divisions awned, the terminal 2-toothed, awned between the teeth; rudiment 3-awned, pilose at base, a second rudimentary scale above.

Plains and hills, mountains of southern California; extends from Manitoba to Montana, south to Mexico.

Locs.—San Bernardino Mts., *Abrams* 2100, *Parish Bros.* 1528, *Wilder* 741; Santa Ana Cañon, *Hall* 7589; Jamacha, *Canby* in 1894.

Refs.—Bouteloua gracilis Lag.; Steud. Nom. Bot. ed. 2. 1: 219. 1840. *Chondrosium gracile* H.B.K. Nov. Gen. & Sp. 1: 176. 1816. *Bouteloua oligostachya* Torr.; Gray, Man. ed. 2. 553. 1856; Thurb. in Wats. Bot. Cal. 2: 291. 1880. *Atheropogon oligostachyum* Nutt. Gen. 1: 78. 1818.

8. **B. hirsuta** Lag. Perennial; culms erect, 8 inches to 1½ feet high; sheaths smooth; blades sparsely papillose-hairy, especially on the margins; spikes 1 to 4, ⅔ to 2 inches long, the rachis produced into a prominent point

beyond the uppermost spikelets; first glume narrow, setaceous; second glume acuminate, twice as long as first and equaling the floret, conspicuously tuberculate-hirsute on the back; lemma pubescent, 3-cleft; rudiment of 2 obtuse lobes and 3 equal awns, not pilose at base.

Mesas of San Diego Co. (Jamacha, *Canby*); extends from British Columbia to South Dakota and Mexico.

Ref.—BOUTELOUA HIRSUTA Lag. Var. Cienc. 2^4: 141. 1805.

41. **BECKMANNIA** Host.

Spikelets 1 or 2-flowered, broad, laterally compressed, articulated below the glumes, closely imbricated in 2 rows along 1 side of the rachis. Glumes subequal, inflated, boat-shaped, chartaceous, the margins scarious. Lemma lanceolate, acuminate. Palea nearly as long as lemma. A tall perennial with flat blades and numerous short appressed spikes in a narrow terminal, nearly simple panicle. Species 1, cooler parts of the northern hemisphere. (Johann Beckmann, 1739—1811, professor of botany at Göttingen.)

1. **B. erucaeformis** Host. Plants light green; culms 1 to 3 feet high; panicle 4 to 10 inches long; spikelets nearly circular, 1½ lines long; glumes transversely wrinkled, the acuminate apex of the lemma protruding.

Swamps and ditches, San Francisco Bay north to Yreka and east to Honey Lake Valley; also in the cooler parts of the northern hemisphere.

Refs.—BECKMANNIA ERUCAEFORMIS Host, Gram. Austr. 3: 5. 1805; Thurb. in Wats. Bot. Cal. 264. 1880; Davy in Jepson, Fl. W. Mid. Cal. 57. 1901. *Phalaris erucaeformis* L. Sp. Pl. 55. 1753.

42. **ELEUSINE** Gaertn.

Spikelets several-flowered, sessile and closely imbricated in 2 rows on 1 side of a continuous rachis, the latter not extending beyond the spikelets. Glumes 2, unequal, shorter than the florets, compressed-keeled, obtuse. Lemmas broader, with a thickened 5-ribbed keel, the uppermost sometimes empty. Coarse tufted annuals, with digitate or approximate, rather stout spikes.—Species about 6, tropical regions of the Old World, 1 species introduced in the warmer portions of the U. S. (Greek Eleusin, the town where Ceres, the goddess of harvests, was worshipped.)

1. **E. indica** Gaertn. Culms flattened, decumbent at base or prostrate-spreading; sheaths loose, overlapping, compressed; spikes 2 to 10, 1 to 3 inches long; spikelets appressed, 3 to 5-flowered, about 2½ lines long.

A common roadside weed in the warmer parts of America, introduced from the Old World. Los Angeles, *Braunton* 1281.

Refs.—ELEUSINE INDICA Gaertn. Fruct. & Sem. 1: 8. 1788. *Cynosurus indicus* L. Sp. Pl. 72. 1753.

43. **LEPTOCHLOA** Beauv.

Spikelets 2 to several-flowered, the uppermost floret usually imperfect or rudimentary, sessile or nearly so, more or less scattered along 1 side of the rachis. Glumes keeled, 1-nerved. Lemmas keeled, 3-nerved, acute, awned or awnless, sometimes 2 or 3-toothed. Annuals or sometimes perennials with elongated simple panicles of slender spikes scattered along a main axis.—Species about 20, in the warm regions of both hemispheres. (Greek leptos, slender, and chloa, grass.)

Glumes longer than first lemma; sheaths papillose-hispid....................1. *L. filiformis.*
Glumes shorter than first lemma; sheaths smooth.
  Lemmas awned ....2. *L. fascicularis.*
  Lemmas awnless ....3. *L. imbricata.*

1. **L. filiformis** Beauv. Culms 1 to 3 feet high, often depauperate; sheaths papillose-hairy; spikes numerous, 1 to 4 inches long, slender, usually purple, the spikelets rather distant, about 1½ lines long; glumes more or less mucronate, nearly equaling the 3 or 4 awnless florets.

Open ground, fields and moist depressions, Imperial Co. (Colorado River, *Schellenger*); common in the warmer parts of America.

Refs.—LEPTOCHLOA FILIFORMIS Beauv. Ess. Agrost. 71, 166. 1812. *Festuca filiformis* Lam. Tabl. Encycl. 1: 191. 1791. *Leptochloa mucronata* Kunth, Rév. Gram. 1: 91. 1829; Abrams, Fl. Los Ang. 42. 1904. *Eleusine mucronata* Michx. Fl. Bor. Am. 1: 65. 1803.

2. **L. fascicularis** Gray. Culms erect or spreading, 1 to 2 feet high; sheaths smooth; blades erect, as long or longer than the culms; spikes numerous, 3 to 5 inches long; spikelets slightly pediceled, 7 to 11-flowered, the florets much longer than the lanceolate glumes; lemmas hairy-margined toward the base, short-awned from the toothed apex.

Ditches and moist, especially alkaline places, Fresno Co. (*Griffiths* 4729) and Kern Co. (*Raymond*); east to Maryland and Florida.

Refs.—LEPTOCHLOA FASCICULARIS Gray, Man. 588. 1848; Thurb. in Wats. Bot. Cal. 2: 292. 1880. *Festuca fascicularis* Lam. Tabl. Encycl. 1: 189. 1791.

3. **L. imbricata** Thurb. Resembles L. fascicularis; usually strictly erect, the panicle more oblong in outline, with shorter spikes; glumes broader and more obtuse; lemmas apiculate but not awned.

Ditches and moist places, San Bernardino Mts. southward to Mexico and east to Louisiana.

Locs.—San Bernardino Mts., *Wilder* 1128, *Wright* 2118; Riverside, *Wheeler* in 1908; Salton Basin, *Schellenger* 55 in 1893; Calexico, *Chase* 5518.

Ref.—LEPTOCHLOA IMBRICATA Thurb. in Wats. Bot. Cal. 2: 293. 1880.

TRIBE VIII. FESTUCEAE.

44. MONANTHOCHLOË Engelm.

Spikelets 2 or 3-flowered, unisexual, the staminate and pistillate somewhat dissimilar, usually sessile in pairs and concealed within the leaf-fascicles, the upper floral leaves becoming smaller, at length reduced to sheaths, and resembling the glumes. Lemmas membranaceous, rigid, obtuse or denticulate. Palea enclosed within the lemma.—Species 1, tropical and subtropical America. (Greek monanthos, one-flower, and chloe, grass.)

1. **M. littoralis** Engelm. A creeping stoloniferous perennial with wiry stems and short rigid crowded leaves.

Salt marshes and mucky or gravelly tidal flats along the coast of tropical seas in the western hemisphere, extending as far north on the Pacific Coast as Santa Barbara.

Locs.—Santa Barbara, *Hitchcock* 2563; San Pedro, *Grant* 295, 3400; Oceanside, *Parish* 4449; San Diego, *Abrams* 3456, *Cleveland* 829.

Refs.—MONANTHOCHLOË LITTORALIS Engelm. Trans. Acad. St. Louis 1: 436. 1859; Abrams, Fl. Los Ang. 44. 1904.

45. ORCUTTIA Vasey.

Spikelets several-flowered, compressed, sessile in loose spikes, the lower spikelets more or less remote. Glumes subequal, broadly lanceolate, irregularly 2 to 5-toothed. Lemmas oblong, many-nerved, 5-toothed at the broad apex, the principal nerves extending into the teeth. Low cespitose annuals with short leaves and rather large spikelets.—Species 2, one from Lower California, the other from Chico. (C. R. Orcutt, a botanist of San Diego.)

1. **O. greenei** Vasey. Culms 6 to 8 inches high, scabrous or appressed-pilose,

especially at the nodes; sheaths finely papillose, shorter than the internodes, the ligule very short; blades about an inch long, pilose on the upper surface, inrolled; spike 1 to 3 inches long, pale; glumes and lemmas sparsely long-pilose and more or less papillose, the glumes 2 lines, the lemmas 3 lines long.

Only known from the type collection. "Moist plains of the upper Sacramento, near Chico, California, June, 1890, by Prof. E. L. Greene."

Ref.—ORCUTTIA GREENEI Vasey, Bot. Gaz. 16: 146. 1891.

46. **ARUNDO** L.

Spikelets 3 or 4-flowered in large terminal panicles. Glumes narrow, subequal, 3-nerved, smooth, acute or acuminate, about as long as the spikelet. Rachilla smooth. Lemma thin, membranaceous, 3-nerved, 2-toothed at apex, mucronate between the teeth, long pilose on the back. Tall reed-like grasses, with hollow culms, and broad flat blades.—Species about 6, in the warmer regions of the Old World, 1 introduced in America. (An ancient Latin name.)

1. **A. donax** L. GIANT-REED. Culms stout, as much as 20 feet high, and an inch in diameter at base, from rough knotty branching rhizomes; blades numerous, broad, flat, 2 to 3 inches wide on the main stem, smaller on the branches, the base cordate and more or less hairy-tufted; panicle large, 1 to 2 feet long; spikelets about 6 lines long.

A native of the Old World, frequently cultivated for ornament in tropical America. Rather common in gardens in the southern U. S. and escaped along irrigating ditches from Texas to central and southern California. The only California specimen in the National Herbarium is from the Alameda marshes, *Davy* in 1898.

Refs.—ARUNDO DONAX L. Sp. Pl. 81. 1753; Davy in Jepson, Fl. W. Mid. Cal. 59. 1901; Abrams, Fl. Los Ang. 44. 1904.

47. **PHRAGMITES** Trin.

Spikelets loosely 3 to 7-flowered, in large terminal panicles. Glumes unequal, lanceolate, acute, shorter than the spikelet. Rachilla clothed with long silky hairs. Lemmas narrow, long-acuminate, glabrous, the lowest longer, equaling the uppermost florets, empty or subtending a staminate flower. Tall reed-like perennials.—Species 3, 1 cosmopolitan, 1 in Asia, and 1 in South America. (Greek phragmites, growing in hedges.)

1. **P. communis** Trin. COMMON REED. Culms as much as 12 feet high, from long creeping rhizomes, these sometimes appearing on the surface of the ground as long leafy stolons as much as 30 feet long; blades as much as 2 inches wide, flat, the base somewhat narrowed, not hairy; panicle 6 to 15 inches long; spikelets 6 to 7 lines long.

Fresh-water swamps, marshes and around springs, through the temperate regions of the world.

Locs.—Mendocino, *Brown* 943; Suisun marshes, *Davy* 4095; Concord, *Elmer* 4541; San Bernardino, *Parish* 5111; Newberry, *Chase* 5779.

Refs.—PHRAGMITES COMMUNIS Trin. Fund. Agrost. 134. 1820; Thurb. in Wats. Bot. Cal. 2: 300. 1880. *P. vulgaris* B. S. P. Prel. Cat. N. Y. 69. 1888; Davy in Jepson, Fl. W. Mid. Cal. 59. 1901. *Arundo vulgaris* Lam. Fl. Franç. 3: 615. 1778. *Phragmites phragmites* Karst. Deutsche Fl. 379. 1880. *Arundo phragmites* L. Sp. Pl. 81. 1753.

48. **TRIDENS** Roem. & Schult.

Spikelets 3 to many-flowered, the uppermost staminate or reduced, in open or contracted panicles. Glumes glabrous. Lemmas 3-nerved, more or less bidentate, the middle nerve often produced between the teeth into an awn, the nerves and callus densely villous. Palea shorter than the lemma, long-ciliate on the nerves below. Perennials with various habit, the above characters covering the California species.—Species about 25, mostly American. (Latin tres, three, and dens, tooth.)

Inflorescence a naked narrow panicle . . . . 1. *T. muticus.*
Inflorescence a leafy head or umbel . . . . 2. *T. pulchellus.*

1. **T. muticus** Nash. Culms erect, 1 to 2 feet high; blades involute, scabrous; panicle narrow, 3 to 6 inches long, exserted, the branches short and appressed; spikelets terete, narrow, 4 to 5 lines long; glumes about 2 lines long, 1-nerved, shorter than the spikelets; lemmas pilose on nerves, obtuse, about 2 lines long, entire or slightly emarginate, awnless.

Dry slopes and gravelly banks, central Sierra Nevada (Silver Mt., *Brewer* 2044), east to Colorado and Texas.

Refs. TRIDENS MUTICUS Nash in Small, Fl. Southeast. U. S. 143. 1903. *Tricuspis mutica* Torr. U. S. Rep. Expl. Miss. Pacif. 4: 156. 1857.

2. **T. pulchellus** Hitchc. n. comb. Low and tufted, usually not over 6 inches high; culms slender, scabrous or puberulous, consisting of 1 long internode, bearing at the top a fascicle of leaves, the fascicle finally bending over to the ground, taking root and producing other culms, the fascicles also producing the inflorescence; sheaths striate, papery-margined, pilose at base; blades involute, short, scabrous, sharp-pointed, striate; panicles much reduced, usually not exceeding the blades of the fascicle, consisting of 1 to 5 nearly sessile spikelets; glumes subequal, broad, acuminate, awn-pointed, 1-nerved, 3 to 4 lines long, and about as long as the spikelet; lemmas 2 lines long, long-pilose below, cleft about half way, the awn about as long or a little longer than the obtuse lobes.

Mesas and rocky hills in the Mohave and Colorado deserts, east to Utah and Texas, and south into Mexico.

Locs.—Funeral Mts., *Coville & Funston* 258; Panamint Cañon, *Hall & Chandler* 6995; Newberry, *Chase* 5789; The Needles, *Chase* 5791; Colorado Desert, *Hall* 5961, *Wilder* 1094.

Refs.—TRIDENS PULCHELLUS Hitchc. *Triodia pulchella* H.B.K. Nov. Gen. & Sp. 1: 155. 1816. *Tricuspis pulchella* Torr. U. S. Rep. Expl. Miss. Pacif. 4: 156. 1857; Thurb. in Wats. Bot. Cal. 2: 301. 1880.

49. DISSANTHELIUM Trin.

Spikelets 2 to 4-flowered, the uppermost reduced to a stipe, arranged in panicles. Glumes narrow, acute, equaling or exceeding the spikelet, the first 1-nerved, the second 3-nerved. Lemma broad, awnless, 3-nerved.—Species 3, 1 in California, the others Mexican and South American. (Greek dissos, double, and anthelios, floret.)

1. **D. californicum** Benth. Culms 2 to 3 feet high, smooth; leaves smooth; ligule membranaceous, 1 to 3 lines long; blades flat, lax; panicle narrow, loose, 6 to 8 inches long, the lower clusters of branches rather remote; glumes somewhat unequal, the first about 1 to 1½ lines long; lemmas about 1½ lines long, minutely villous, especially below.

Known only from California: Tassajara Hot Springs, *Elmer* 3317; San Clemente Island, *Trask* 324. The specimens at hand are apparently annual.

Refs.—DISSANTHELIUM CALIFORNICUM Benth. in Hook. Icon. Pl. III. 4: 56. pl. 1375. 1881. *Stenochloa californica* Nutt. Jour. Acad. Phila. II. 1: 189. 1848, type from Santa Catalina Island, *Gambel;* Thurb. in Wats. Bot. Cal. 2: 315. 1880.

50. ERAGROSTIS Host.

Spikelets 3 to many-flowered, usually strongly compressed, in open or contracted panicles. Glumes keeled, much shorter than the spikelets. Lemmas

3-nerved, broad, keeled. Palea shorter than the lemma, often persistent on the rachilla, the strong nerves ciliate. Annuals or perennials.—Species about 100, in warm and temperate regions of both hemispheres. (Greek er, spring, and agrostis, a grass.)

Plants perennial.
  Panicle narrow and compact, more or less interrupted................1. *E. secundiflora.*
  Panicle loose and open..2. *E. lugens.*
Plants annual.
  Spikelets dioecious or polygamous.....................................8. *E. hypnoides.*
  Spikelets perfect.
    Spikelets ovate to oblong-ovate, about 1½ lines wide; keel of lemmas glandular and scabrous..5. *E. megastachya.*
    Spikelets linear, ½ to 1 line wide; keel of lemmas scabrous but not glandular.
      Panicle pilose in the lower axils.
        Lower lemmas ½ line wide..7. *E. limbata.*
        Lower lemmas ¼ line wide..6. *E. pilosa.*
      Panicle glabrous in the axils.
        Pedicels flexuous and spreading; lower lemmas ¼ line wide.......4. *E. orcuttiana.*
        Pedicels nearly straight, ascending or appressed; lower lemmas ⅓ line wide........3. *E. mexicana.*

1. **E. secundiflora** Presl. Perennial; culms erect or decumbent at base, stiff, 1 to 2 feet high; sheaths pilose at the throat; panicles narrow, the branches ascending, compactly flowered, approximate or more or less remote; spikelets many flowered, the florets closely imbricated, usually tinged with red; glumes 1-nerved, the second 1 line long; lemmas prominently 3-nerved, scabrous on keel, broad at base, the acuminate apex somewhat divergent.

Sandy prairies, Kansas to Florida and Mexico and west to southern California. San Diego, *Orcutt* in 1884.

Refs.—ERAGROSTIS SECUNDIFLORA Presl, Rel. Haenk. 1: 276. 1830. *E. oxylepis* Torr. U. S. Rep. Expl. Miss. Pacif. 4: 156. 1857. *Poa oxylepis* Torr. in Marcy, Expl. Red Riv. 301. 1853. *P. interrupta* Nutt. Trans. Am. Phil. Soc. II. 5: 196. 1837, not Lam. 1791.

2. **E. lugens** Nees. Perennial; culms erect, 2 to 3 feet high; leaves mostly basal, the blades narrow, involute; panicle large and diffuse, about ½ the length of the entire plant; spikelets 3 to 4 lines long, about ¾ line wide; second glume 1 line long; lower lemmas 1 line long, ⅓ line wide.

Sandy prairies, San Diego Co. (Jamacha, *Canby*) to Texas and south to South America.

Ref.—ERAGROSTIS LUGENS Nees, Agrost. Bras. 505. 1829.

3. **E. mexicana** Link. Annual; culms erect or spreading, 1 to 2 feet high; sheaths hairy at the throat; blades often elongated; panicle large and diffuse, glabrous in the axils, 6 to 12 inches long; spikelets 2 to 3 lines long, ¾ line wide, mostly 6 to 12-flowered, the pedicels slender, flexuous, mostly longer than the spikelet; glumes acuminate, the second about 1 line long; lemmas smooth, the lower 1 line long, ⅓ line wide, the lateral nerves not prominent.

A weed in fields and waste places, southern California (Los Angeles, Riverside) to New Mexico and southward to Mexico.

Refs.—ERAGROSTIS MEXICANA Link, Hort. Berol. 1: 190. 1827. *Poa mexicana* Lag. Gen. & Sp. Nov. 3. 1816.

4. **E. orcuttiana** Vasey. Resembling E. mexicana; differing in the more slender, usually arcuate spikelets on shorter pedicels; spikelets 2½ to 3 lines long, ⅓ to ½ line wide; glumes short, the first ½ line, the second ¾ line long; lemmas scarcely ¼ line wide.

Fields and waste places, known only from California.

Locs.—Yreka, *Butler* 869; Castle Crag, *Hitchcock* 3063; Amador Co., *Hansen* 813, 2086;

Ione, *Braunton* 1209; Greenfield, *Leckenby* in 1896; Pomona, *Davy* 2951; Lugonia (Redlands), *Parish* 2484.

Refs.—ERAGROSTIS ORCUTTIANA Vasey, Contr. Nat. Herb. 1: 269. 1893, type from Chollas Valley, San Diego, *Orcutt* 1313. Referred to *E. pilosa* by Abrams (Fl. Los Ang. 45. 1904).

5. **E. megastachya** Link. Annual, strong-scented when fresh; culms erect or ascending from a decumbent base, rather flaccid, freely branching, 8 inches to 2 feet high; blades 2 to 6 inches long, 1½ to 3 lines wide; panicles greenish lead-color, 2 to 6 inches long, rather densely flowered; spikelets 2½ to 7 lines long, 1½ lines wide, 10 to 40-flowered, the florets closely imbricated; pedicels and keels of the acute glumes and lemmas sparingly glandular; lemmas thin, the lateral nerves prominent.

Fields, roadsides and waste places, a common weed, throughout the U. S. and Mexico, introduced from Europe. Middle Tule, *Purpus* 5614; Los Angeles, *Davidson;* San Bernardino, *Parish.*

Refs.—ERAGROSTIS MEGASTACHYA Link, Hort. Berol. 1: 187. 1827. *Poa megastachya* Koeler, Descr. Gram. 181. 1802. *Briza eragrostis* L. Sp. Pl. 70. 1753 (not *Poa eragrostis L.*). *Eragrostis major* Host, Gram. Austr. 4: 14. pl. 24. 1809; Abrams, Fl. Los Ang. 45. 1904. *E. poaeoides* Beauv. var. *megastachya* Gray, Man. ed. 5. 631. 1867; Thurb. in Wats. Bot. Cal. 2: 315. 1880. *E. minor* Host var. *megastachya* Davy in Jepson, Fl. W. Mid. Cal. 60. 1901.

E. MINOR Host. (Fl. Austr. 1: 135. 1827) is mentioned by Davy (Jepson, Fl. W. Mid. Cal. 60. 1901) and by Thurber (Wats. Bot. Cal. 2: 315. 1880, as E. poaeoides Beauv.) but the specimens probably belong to E. pilosa Beauv.

6. **E. pilosa** Beauv. Annual; culms erect, decumbent at base or prostrate-spreading, 6 inches to 1½ feet high, diffusely branched at base; sheaths sparingly pilose at summit; blades 1 to 4 inches long, 1 to 1½ lines wide; panicle diffuse, 3 to 8 inches long, the lower axils sparingly bearded; spikelets 5 to 18-flowered, becoming linear, 2 to 4 lines long, ½ to ¾ line wide, equaling or shorter than the pedicels; glumes 1-nerved, smooth except the keels, the first ½ line, the second ¾ line long; lemmas smooth, slightly scabrous on keel, the lower about ¾ line long, ¼ line wide, the lateral nerves distinct but not prominent.

Fields, waste places and open ground, San Luis Obispo and Tulare Co. southward; extends from Maine to Minnesota and south to Mexico. Introduced from Europe but also apparently native in some localities.

Refs.—ERAGROSTIS PILOSA Beauv. Ess. Agrost. 162. 1812; Abrams, Fl. Los Ang. 45. 1904. *Poa pilosa* L. Sp. Pl. 68. 1753.

E. ALBA Presl, Rel. Haenk. 1: 279. 1830. The type locality as published is "Monte-Rey Californiae." The type specimen in the Bohemian National Museum at Prague is labeled, "Regiomontane", which would indicate that the specimen came from Peru, as many of Haenke's specimens from Peru are labeled in this way. As indicated by Scribner (Rep. Mo. Bot. Gard. 10: 43. pl. 44. 1899), the Haenke specimen appears to be *Poa pastoensis* H.B.K. (see Kunth, Rév. Gram. pl. 145) the type locality of which is Peru. The labels on Haenke's type specimens are scanty and confusing, and some evidently have been interchanged. The specimens in the Gray Herbarium mentioned under *E. alba* by Thurber (Wats. Bot. Cal. 2: 315. 1880) are all Eragrostis pilosa.

7. **E. limbata** Fourn. Resembles E. pilosa, differing in its relatively smaller panicles and larger spikelets; lower lemma 1 line long, ½ line wide.

Mesas, San Diego Co. (Jamacha, *Canby*) to Mexico.

Refs.—ERAGROSTIS LIMBATA Fourn. Mex. Pl. 2: 116. 1886. Mentioned without description by Hemsley (Biol. Centr. Am. Bot. 3: 573. 1885).

8. **E. hypnoides** B.S.P. Annual, extensively creeping; culms slender, 8 inches to 1½ feet long, with short, erect or ascending, panicle-bearing branches,

2 to 4 inches high; blades ½ to 1½ inches long; panicles mostly simple, of rather few lanceolate-oblong spikelets, the fertile inflorescence tending to be capitate; spikelets 10 to 35-flowered, 2½ to 7 lines long, the flowers more or less dioecious.

Sand bars and wet shores of rivers and lakes, throughout the U. S. and south to South America.

Locs.— Mendocino, *Brown* 928; Lower Sacramento, *Jepson* in 1891; Lathrop, *Bioletti* 144; Clear Lake, *Parish* in 1882; Los Angeles, *Nevin*.

Refs.—ERAGROSTIS HYPNOIDES B.S.P. Prel. Cat. N. Y. 69. 1888; Davy in Jepson, Fl. W. Mid. Cal. 60. 1901. *Poa hypnoides* Lam. Tabl. Encycl. 1: 185. 1791. *Eragrostis reptans* Nees, Agrost. Bras. 514. 1829; Thurb. in Wats. Bot. Cal. 2: 314. 1880.

51. **ANTHOCHLOA** Nees & Meyen.

Spikelets several-flowered, in capitate or cylindrical panicles. Glumes small or wanting. Lemmas thin-membranaceous, flabelliform, or petal-like, many-nerved. Palea narrower than the lemma, hyaline. Low cespitose grasses with flat blades and panicles partially included in the sheaths.—Species 3, Andes of Bolivia and Peru, 1 in California. (Greek anthos, flower, and chloa, grass.)

1. **A. colusana** Scribn. Annual; culms ascending from a decumbent base, 3 to 12 inches long; leaves overlapping, pale green, scarious between the nerves, loosely folded around the culm but not differentiated into sheath and blade, about 6 lines wide at the middle, tapering to each end, 2 to 4 inches long, keeled on the back above, plicate, minutely ciliate with raised glands on the margins and nerves; panicles pale green, cylindrical, at first partially included, never much exserted, 1½ to 3 inches long, 4 to 6 lines wide, the upper portion of the axis bearing, instead of spikelets, lanceolate-linear empty bracts 4 lines long; spikelets subsessile, usually 5-flowered, 3 to 3½ lines long, imbricated; glumes wanting; lemmas flabellate, very broad, many-nerved, 2½ lines long, ciliolate-fringed.

Only known from the type collection, "near Princeton, Colusa County, California, bordering rain-pools on the hard uncultivated alkali 'goose-lands,' beside the stage road to Norman; May 26, 1898, *J. Burtt Davy.*"

Refs.—ANTHOCHLOA COLUSANA Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 17: 221. f. 517. 1899. *Stapfia colusana* Davy, Erythea 6: 110. pl. 3. 1898. *Neostapfia colusana* Davy, Erythea 7: 43. 1899.

52. **MELICA** L.

Spikelets 2 to several-flowered, in panicles. Glumes large, unequal, membranaceous or papery, scarious-margined, 3 to 5-nerved, awnless, a little shorter than the florets. Rachilla prolonged beyond the uppermost fertile floret and bearing 2 or 3 gradually smaller empty lemmas more or less convolute and enclosing one another at the apex. Lemmas firm with scarious margins, 7-nerved, awnless, or awned below the bifid apex. Perennials, often bulbous at base, with closed sheaths and usually few-flowered panicles.—Species about 30 in temperate regions. (An old Italian name for sorghum, from mel, honey.)

Spikelets narrow; glumes usually narrow, scarious margined; sterile lemmas similar to the fertile, the latter acute or awned.
  Lemmas long awned . . . . 1. *M. aristata.*
  Lemmas awnless or very short-awned.
    Culms not bulbous at base. . . . . 2. *M. harfordii.*
    Culms bulbous at base.
      Lemmas acuminate; panicle narrow, the branches short.............3. *M. subulata.*
      Lemmas acute, not acuminate; panicle broad, the branches long and spreading.......
4. *M. geyeri.*

Spikelets broad; glumes broad and papery; sterile lemmas small and convolute around each other, more or less hidden in the upper fertile lemmas.
  Culms bulbous at base.
    Pedicels capillary, flexuous or recurved ....5. *M. spectabilis.*
    Pedicels stouter, appressed.
      Panicle narrow; branches short, erect.................................6. *M. bella.*
      Panicle open; branches spreading.
        Spikelets about 3 lines long ....7. *M. fugax.*
        Spikelets about 6 lines long ....8. *M. inflata.*
  Culms not distinctly bulbous at base (somewhat bulbous in M. bulbosa).
    Spikelets large, reflexed ....9. *M. stricta.*
    Spikelets smaller, not reflexed.
      Fertile florets 3 or 4 in each spikelet; spikelets 5 to 6 lines long.
        Spikelets silvery white; glumes about as long as spikelet; plant tall and somewhat woody ....10. *M. frutescens.*
        Spikelets tawny or purplish; glumes shorter than spikelet; plant lower, herbaceous... 11. *M. bulbosa.*
      Fertile florets 1 or 2 in each spikelet; spikelets 2 to 3 lines long.
        Fertile lemmas pubescent ....12. *M. torreyana.*
        Fertile lemmas glabrous ....13. *M. imperfecta.*

1. **M. aristata** Thurb. Culms erect or decumbent below, not bulbous at base, smooth, 2 to 3 feet high; sheaths scabrous or pubescent; blades flat, more or less pubescent; panicle narrow, the branches short and appressed; glumes narrow, 5-nerved, 5 to 6 lines long; lemmas 5-nerved, scabrous, bifid at apex, awned, the awn 3 to 5 lines long.

Dry woods, slopes and meadows. Washington, southward in the Sierra Nevada to Fresno Co.

Locs.—Siskiyou Co., *Butler* 811; Mt. Shasta, *Hitchcock* 2944; Grizzly Hill, *Leiberg* 5121; Emigrant Gap, *Jones* in 1882; Lake Tahoe, *Reed & Pendleton* 1726; Mt. Tallac, *Hitchcock* 3163; Pioneer, *Hansen* 1849; Yosemite Valley, *Hitchcock* 3349; Northfork, *Griffiths* 4581, 6670; Pine Ridge, *Hall & Chandler* 314.

Refs.—MELICA ARISTATA Thurb.; Boland. Proc. Cal. Acad. 4: 103. 1870, type from Clark's (now Wawona), *Bolander* 4861; Thurb. in Wats. Bot. Cal. 2: 305. 1880.

2. **M. harfordii** Boland. Culms 2 to 4 feet high, decumbent below, smooth, not bulbous at base; sheaths smooth; blades scabrous, firm; panicle narrow, the branches appressed; glumes narrow, about 3 lines long, obtuse; lemmas 7-nerved, pilose on lower part of margin, the apex emarginate, mucronate or short-awned; awn less than 1 line long.

Open dry woods and slopes, Coast Ranges from Monterey Co. to Castella and north to British Columbia.

Refs.—MELICA HARFORDII Boland. Proc. Cal. Acad. 4: 102. 1870, three specimens mentioned, *Bolander* 53, 6464, and one from Bear Valley, Nevada Co., in 1869; Thurb. in Wats. Bot. Cal. 2: 305. 1880.

3. **M. subulata** Scribn. Culms 2 to 4 feet high, bulbous at base; panicle narrow, the branches appressed; spikelets narrow, $^3/_4$ to 1 inch long, loosely several-flowered; glumes narrow, obscurely nerved, the second about 4 lines long, shorter than the lower lemma; lemmas prominently 7-nerved, gradually narrowed to an acuminate point, awnless, the keel and marginal nerves pilose-ciliate.

Meadows, banks and shady slopes, from Siskiyou Co. and Trinity Summit to Lake Tahoe (*Reed & Pendleton* 1686) and Mt. Tamalpais (*Piper* 6343); north to Alaska and east to Wyoming.

Refs.—MELICA SUBULATA Scribn. Proc. Acad. Phila. 1885: 47. 1885. *Bromus subulatus* Griseb. in Ledeb. Fl. Ross. 4: 358. 1853. *Melica acuminata* Boland. Proc. Cal. Acad. 4: 104.

1870, type *Bolander* 4698 (from Mendocino City acc. to Bolander's Field Book); Thurb. in Wats. Bot. Cal. 2: 305. 1880.

4. **M. geyeri** Munro. Culms 3 to 5 feet high, bulbous at base; sheaths glabrous or sometimes pubescent; blades scabrous, flat; panicle open, the lower branches slender, spreading, bearing a few spikelets above the middle; spikelets narrow, 6 to 10 lines long; glumes broad, smooth, papery, the second about 3 lines long; lemmas scaberulous, obtuse, awnless.

Wooded ravines and along streams, central California to Oregon.

Locs.—Quincy, *Austin* 1608; Sherwood, *Hitchcock* 2728; Ukiah, *Bolander* 3832, 6119, *Davy* 5027; Cahto, *Davy* 6625; Mt Sanhedrin, *Heller* 5885; Emigrant Gap, *Jones* 3553; Santa Clara Co., *Heller* 7420; Congress Springs, *Hitchcock* 2669.

Refs.—MELICA GEYERI Munro; Boland. Proc. Cal. Acad. 4: 103. 1870, type *Bolander* 6119. *M. bromoides* Boland.; Gray, Proc. Am. Acad. 8: 409. 1872 (Gray cites *M. geyeri* Boland. l. c.); Thurb. in Wats. Bot. Cal. 2: 304. 1880.

5. **M. spectabilis** Scribn. Culms 1 to 3 feet high, bulbous at base; panicle narrow, the branches appressed; spikelets broad, purple-tinged, 4 to 5 lines long, 4 or 5-flowered, the pedicels slender, curved; glumes broad and papery, shorter than the lower lemma; lemmas strongly 7-nerved, obtuse, awnless.

Rocky or open woods and thickets; Sherwood, *Hitchcock* 2715 and Trinity Summit, *Davy* 5827, north to Washington and east to Montana and Colorado.

Ref.—MELICA SPECTABILIS Scribn. Proc. Acad. Phila. 1885: 45. 1885.

6. **M. bella** Piper. Culms 1 to 2 feet high, bulbous at base; sheaths and blades glabrous or scabrous; panicle narrow, the branches short and appressed; spikelets 5 to 6 lines long, papery with age; glumes broad, the second 4 lines long; lemmas obscurely nerved, obtuse or slightly emarginate, awnless.

Rocky woods and hills; central California to Washington, east to Montana and Colorado.

Locs.—Mt. Shasta, *Palmer* 2641 in 1892; Long Valley, Mendocino Co., *Davy* 5323; Webber Lake, *Doten* 83; Truckee River, *Davy* 3258; Mt. Tallac, *Hitchcock* 3153; Mt. Hamilton, *Davy;* Mariposa Co., *Congdon;* Sequoia Nat. Park, *Hitchcock* 3387.

Var. **intonsa** Piper. Leaves softly pubescent.—California to Washington. Yreka, *Butler* 1251; Cuyama, *Eastwood* in 1896; Paso Robles, *Grant* 5365.

Refs.—MELICA BELLA Piper, U. S. Dept. Agr. Div. Agrost. Circ. 27: 10. 1900. ***M. bulbosa*** [Geyer, misapplied by] Vasey U. S. Dept. Agr. Div. Bot. Bull. 13^2: pl. 63. 1893 (the earliest description). Var. INTONSA Piper, Contr. Nat. Herb. 11: 128. 1906.

7. **M fugax** Boland. Culms 1 to 2 feet high, bulbous at base; sheaths and blades smooth; panicle narrow, open, the few lower branches 1 to 2 inches long, stiffly spreading, few-flowered; spikelets about 3 lines long, 2 or 3-flowered, usually purple-tinged; glumes broad, papery, the second nearly as long as spikelet; lemmas obscurely nerved, obtuse or emarginate, awnless.

Dry hills, northern California to Washington. Yreka, *Butler* 824; without locality, *Lemmon* in 1875. These specimens belong to the var. madophylla Piper, differing from the species in being smooth.

Refs.—MELICA FUGAX Boland. Proc. Cal. Acad. 4: 104. 1870, 2 specimens cited, Donner Lake, and Lake Tahoe; Thurb. in Wats. Bot. Cal. 2: 304. 1880. Var. *madophylla* Piper, Contr. Nat. Herb. 11: 128. 1906.

8. **M. inflata** Vasey. Culms 2 to 3 feet high, bulbous at base; panicle more or less open, the few branches long, spreading at least in anthesis; spikelets several flowered, ½ inch long, broad, pale green; glumes broad, shorter than the lemmas, scabrous on the strong nerves; lemmas scabrous, strongly nerved.

Wet meadows, only known from California. Mt. Shasta, *Lemmon* 5448; Yosemite Nat. Park, Hog Ranch, *Hall & Babcock* 3334.

Refs.—Melica inflata Vasey, Contr. Nat. Herb. 1: 269. 1893. *M. poaeoides* Nutt. var. *inflata* Boland. Proc. Cal. Acad. 4: 101. 1870, type from Yosemite Valley, *Bolander* 6121. Mentioned under *M. bulbosa* Geyer, by Thurber (Wats. Bot. Cal. 2: 304. 1880).

9. **M. stricta** Boland. Culms ½ to 1½ feet high, the base somewhat thickened but not bulbous; panicle narrow, few-flowered, nearly simple, usually 1 or 2 branches below; spikelets large, about ½ inch long, reflexed on rather delicate pedicels; glumes nearly as long as spikelet, longer than the lower lemma; lemmas scabrous, obtuse, awnless.

Rocky slopes and banks, Eagle Lake (*Jones*) through the Sierra Nevada to Sequoia Nat. Park (*Hall & Babcock* 5684) and Coso Mts. (*Coville & Funston* 936), and in the Coast Ranges (Mt. Pinos, Kern Co., *Hall* 6404) to San Bernardino Mts. (*Parish Bros.* 1553); north into Oregon and east to Utah.

Refs.—Melica stricta Boland. Proc. Cal. Acad. 3: 4. 1863; op. cit. 4: 104. 1872; Thurb. in Wats. Bot. Cal. 2: 303. 1880.

10. **M. frutescens** Scribn. Culms 2 to 6 feet high, rather woody below, not bulbous at base; blades short, especially on the branches and innovations; panicle silvery-shining, narrow, the branches short and appressed; spikelets about ½ inch long; glumes about as long as the spikelet, prominently 5 nerved; lemmas acute, entire, awnless, 7-nerved.

Southern California to Lower California.

Locs.—Panamint Cañon, *Hall & Chandler* 7031; Riverside, *Griffiths* 7851; San Jacinto, *Jones* 3554; Masons, *Brandegee* 135 in 1896; Bernardo, *Abrams* 3361; San Diego Co., *Mearns* 3033.

Refs.—Melica frutescens Scribn. Proc. Acad. Phila. 1885: 45. 1885, type locality, vicinity of San Diego, several specimens cited, the first being *Parry & Lemmon* 401.

11. **M. bulbosa** Geyer. Culms 2 to 4 feet high, the base usually decumbent and often more or less bulbous or corm-like; lower sheaths on the older culms persistent, brown and split into numerous fibers; panicle narrow, rather densely flowered, 4 to 8 inches long, tawny or purplish, not silvery shining; spikelets 5 to 6 lines long, papery, 3 or 4-flowered; second glume about 3½ lines long; lemmas rather prominently 7-nerved, awnless.

Mountain meadows and rocky woods, Ventura Co. north to Oregon and Nevada. The following specimens are softly pubescent: Northfork, *Griffiths* 4415; Yosemite Valley, *Chase* 5712; Tehachapi, *Chase* 5734.

Refs.—Melica bulbosa Geyer; Thurb. in Wats. Bot. Cal. 2: 304. 1800. *M. californica* Scribn. Proc. Acad. Phila. 1885: 46. 1885; Davy in Jepson, Fl. W. Mid. Cal. 62. 1901. *M. poaeoides* [Nutt. misapplied by] Torr. U. S. Rep. Expl. Miss. Pacif. 4: 157. 1857; Boland. Proc. Cal. Acad. 4: 101. 1870. (*M. bulbosa* Geyer in Hook. Jour. Bot. & Kew Misc. 8: 19. 1856, and in Gray, Proc. Am. Acad. 8: 409. 1872, are both nomina nuda. See also U. S. Dept. Agr. Div. Agrost. Circ. 27: 10. 1900.) *M. longiligula* Scribn. & Kearn. U. S. Dept. Agr. Div. Agrost. Bull. 17: 225. f. 521. 1899, type *Parish Bros.* 865.

12. **M. torreyana** Scribn. Culms from a loose and decumbent base, 1 to 3 feet high, not bulbous; blades flat, lax; panicle narrow, rather loose, the branches more or less fascicled, appressed or ascending, the lower fascicles distant; spikelets 2 to 3 lines long, with 1 or 2 perfect florets and a rudiment; glumes strongly nerved, nearly as long as spikelet; lemmas pubescent; rudiment long-pediceled, obovoid-truncate, divergent.

Thickets and banks at low altitudes, central California, especially in the Bay region.

Locs.—Mendocino Co., *McMurphy* 422; Butte Co., *Heller* 5511; Sacramento, *Michener* 154; Mariposa Co., *Congdon*; various localities in the Bay region from Mt. Tamalpais to Santa Cruz, *Baker* 2815, *Bolander* 1539, 6076, *Davy* 4257, 7857, *Heller* 5084, 8397, *Hitchcock* 2668, *Palmer* 2046, *Piper* 6304, 6339, *Rutter* 97.

Refs.—MELICA TORREYANA Scribn. Proc. Acad. Phila. 1885: 43. 1885, type appears to be *Torrey* 586 from New Almaden, *Bolander* 6076 also mentioned; Davy in Jepson, Fl. W. Mid. Cal. 62. 1901.

13. **M. imperfecta** Trin. Culms erect, 1 to 3 feet high; blades narrow, usually not over 1 line wide; panicle narrow, from a few inches to a foot in length, the branches more or less fascicled, long and short together; spikelets 2 to 3 lines long, purple-tinged, usually with 1 perfect floret and a rudiment; glumes indistinctly nerved; lemma a little longer than the glumes, smooth, indistinctly nerved, obtuse; rudiment oblong, short-pediceled, appressed to the palea.

Dry open woods and rocky hillsides, Coast Ranges from the Bay region south into Lower California. Two specimens come from further inland, mouth of Kern Cañon, *Heller* 7652, and Dunlap to Millwood, *Griffiths* 4665. The following specimens have larger spikelets: *Abrams* 1220, *Jones* 3092 (one specimen), *Parish Bros.* 885, *Wilder* 1079. Reed's no. 938 from Box Spring Mt., provisionally referred to this species, differs in having a narrow shining interrupted spike-like panicle, the branchlets and pedicels villous; the spikelets having 1 perfect floret.

Var. **refracta** Thurb. Differs in having pubescent blades and spreading or reflexed lower branches of the panicle —Gravelly brushy slopes, southern California and Lower California.

Locs.—Mt. Pinos, *Hall* 6736; Tehachapi, *Chase* 5738; Mt. Wilson, *Chase* 5573; Los Angeles, *Elmer* 3646; San Gabriel Forest Res., *Leiberg* 3362; Erskine Creek, *Purpus* 5078, 5078a; Santa Cruz Island, *Brandegee* 64 in 1888.

Var **flexuosa** Boland. Blades glabrous; lower panicle branches spreading or reflexed.—Wooded hillsides and rocky banks, central and southern California.

Locs.—Mariposa Creek, *Congdon;* Yosemite Valley, *Chase* 5696; Northfork, *Griffiths* 4586; Pacific Grove, *Hitchcock* 2620; Laguna, *Schoenfeldt* 3607, 3662; Jacumba Hot Springs, *Schoenfeldt* 3233; various localities from Santa Barbara to San Diego, *Abrams* 1346, 3343, *Baker* 4198, *Hall* 2079, *Leiberg* 3219.

Var. **minor** Scribn. Blades glabrous, very narrow; plant low, less than 1 foot high, a scarcely distinct variety.—Dry hillsides and crevices of rocks, southern California and Lower California.

Locs.—Loma Prieta, *Davy* 426, 568; Nacimiento River, *Davy* 7645; Sequoia Nat. Park, *Davidson* 2105; Ft. Tejon, *Parish* 1997; Mt. Wilson, *Grant* 6244; Colorado Desert, *Mearns* 2976; between Campo and Jacumba, *Abrams* 3630; Santa Catalina Island, *Trask.*

Refs.—MELICA IMPERFECTA Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 2^1: 59. 1836, type locality California, no specimen mentioned; the type in the Trinius Herbarium is labeled, "Nova California, Douglas, 1833"; Thurb. in Wats. Bot. Cal. 2: 303. 1880; Davy in Jepson, Fl. W. Mid. Cal. 61. 1901; Abrams, Fl. Los Ang. 46. 1904. *M. panicoides* Nutt. Jour. Acad. Phila. II. 1: 188. 1848, type from Santa Barbara, *Gambel.* Var. REFRACTA Thurb. in Wats. Bot. Cal. 2: 303. 1880, type from San Bernardino, *Lemmon;* Abrams, Fl. Los Ang. 47. 1904. Var. *pubens* Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 30: 8. 1901, type from Santa Cruz Island, *Brandegee* 64 in 1888. Var. FLEXUOSA Boland. Proc. Cal. Acad. 4: 101. 1870, type locality, "Mariposa to Clark's"; Thurb. in Wats. Bot. Cal. 2: 303. 1880; Abrams, Fl. Los Ang. 46. 1904. Var. MINOR Scribn. Proc. Acad. Phila. 1885: 42. 1885, type from San Bernardino Mts., *Parish Bros.* 856; Abrams, Fl. Los Ang. 46. 1904. *M. poaeoides* Nutt. Jour. Acad. Phila. II. 1: 188. 1848, type said to be from "Island of Santa Catalina", *Gambel.* Through the kindness of Dr. A. B. Rendle, of the Herbarium of the British Museum, I have been able to examine the type specimen of *M. poaeoides* Nutt. It is a good match for Brandegee's no. 114 from La Jolla, collected April 17, 1894. The label accompanying the type specimen gives as the locality, "St. Diego." *M. parishii* Vasey; Beal, Grasses N. Am. 2: 500. 1896, type *Parish* 1997.

53. **PLEUROPOGON** R. Br.

Spikelets many-flowered, linear, in loose racemes. Glumes unequal, membranaceous or subhyaline, 1-nerved or the second imperfectly 3-nerved, shorter than the lemmas. Lemmas membranaceous, 7-nerved, forming a round indurated callus at base, entire or somewhat 2-toothed at the apex, with the midnerve extending into a short mucro or awn. Palea 2-keeled, the keels winged or appendaged. Soft annuals or perennials with flat blades and rather large spikelets.—Species 3, 2 in the U. S. and 1 in the Arctic regions. (Greek pleura, side, and pogon, beard.)

Lemmas about 3 lines long, scabrous and strongly nerved; spikelets not refracted; culm usually not over 2 feet tall..1. *P. californicus.*
Lemmas about 4 lines long, smooth or slightly scabrous; spikelets often refracted; culms usually over 3 feet high..2. *P. refractus.*

1. **P. californicus** Benth. Annual; culms 1 to 2 feet high; blades short, abruptly narrowed at apex; racemes 6 to 8 inches long; spikelets distant, about an inch long, erect or somewhat spreading, short-pediceled; glumes obtuse, erose at apex, the first 2 lines, the second 3 lines long; lemmas rather distant, 3 lines long, scabrous, toothed and scarious at apex, the nerves prominent; the awn variable, usually 3 to 6 lines long, sometimes wanting; wings of palea prominent, cleft to form a tooth about the middle.

Wet meadows and marshy ground, Mendocino Co. to the San Francisco Bay region.

Locs.—Sherwood Valley, *Davy* 5129; Santa Rosa, *Heller* 5294; Petaluma, *Piper* 6319; San Rafael, *Blankinship* 19; Marin Co., *Michener & Bioletti* 122; Walnut Creek, *Brewer* 1043; Oakland, *Bolander* 1545, 6075; San Bruno Hills, *Elmer* 4848.

Refs.—PLEUROPOGON CALIFORNICUS Benth; Vasey, Grasses U. S. 40. 1883; U. S. Dept. Agr. Div. Bot. Bull. 13^2: pl. 68. 1893; Davy in Jepson, Fl. W. Mid. Cal. 63. 1901. *Lophochlaena californica* Nees, in Tayl. Ann. Nat. Hist. 1: 283. 1838, type from "California," *Douglas;* Thurb. in Wats. Bot. Cal. 2: 306. 1880.

2. **P. refractus** Benth. Perennial; culms 3 to 5 feet high; spikelets about as in P. californicus, spreading, or often reflexed; lemmas 4 lines long, only minutely scabrous, the nerves less prominent; awn variable, as much as ½ inch long or nearly wanting; palea narrow, keeled to about the middle.

Bogs, wet meadows and mountain streams, Mendocino and Humboldt cos. to Washington.

Locs.—Humboldt Bay, *Chandler* 1107; Russian Gulch, *Davy* 6586; Comptche, *McMurphy* 455; Cahto, *Davy* 6626.

Refs.—PLEUROPOGON REFRACTUS Benth.; Vasey, Grasses U. S. 40. 1883; U. S. Dept. Agr. Div. Bot. Bull. 13^2: 69. 1893. *Lophochlaena refracta* Gray, Proc. Am. Acad. 8: 409. 1872; Thurb. in Wats. Bot. Cal. 2: 307. 1880.

54. **DISTICHLIS** Raf.

Spikelets many-flowered, dioecious, strongly compressed, in small panicles. Glumes unequal, firm, keeled, acute. Lemmas coriaceous, rigid, faintly many-nerved. Rigid erect perennials, with stout rhizomes, and dense panicles of rather few spikelets.—Species about 5, salt marshes and alkaline interior plains, temperate America. (Greek distichos, two-ranked.)

1. **D. spicata** Greene. Pale or glaucous; culms 4 inches to 2 feet high; sheaths overlapping; blades often conspicuously distichous, rigidly ascending; panicle narrow, 1 to 3 inches long; spikelets 4 to 8 lines long, the florets closely imbricated.

Salt marshes and alkaline soil; common in California along the coast and the interior deserts and valleys; not found at high altitudes. Throughout the U. S. and Mexico.

Refs.—DISTICHLIS SPICATA Greene, Bull. Cal. Acad. 2: 415. 1887; Davy in Jepson, Fl. W. Mid. Cal. 63. 1901; Abrams, Fl. Los Ang. 47. 1904. *Uniola spicata* L. Sp. Pl. 71. 1753. *Distichlis maritima* Raf. Jour. de Phys. 89: 104. 1819; Thurb. in Wats. Bot. Cal. 2: 306. 1880. Var. *stricta* Thurb. in Wats. Bot. Cal. 2: 306. 1880. *Uniola stricta* Torr. Ann. Lyc. N. Y. 1: 155. 1824.

55. BRIZA L.

Spikelets several-flowered, compressed, rounded-ovate or triangular, in panicles. Glumes membranaceous, with broad scarious margins, strongly concave, rounded on the back and more or less ventricose. Lemmas similar, 3 to many-nerved, nearly horizontal to the axis. Annuals or perennials, the California species with open panicles of handsome spikelets.—Species 12, in the temperate regions of Europe, North Africa, Mexico and South America, and certain species introduced into the U. S. (An ancient Greek name for a kind of grain, probably rye.)

Plants perennial .... 1. *B. media.*
Plants annual.
  Panicle drooping; spikelets 5 lines broad .... 2. *B. maxima.*
  Panicle erect; spikelets not over 2 lines broad .... 3. *B. minor.*

1. **B. media** L. Perennial; culms erect, 1 to 2 feet high, erect or decumbent at base; panicle erect, pyramidal, many-flowered, the branches capillary, stiffly ascending or spreading; spikelets nodding, 3 lines long, heart-shaped, or triangular-ovate.

Sparingly introduced from Europe. Bennett Valley, *Heller* 5649.

Refs.—BRIZA MEDIA L. Sp. Pl. 70. 1753; Thurb. in Wats. Bot. Cal. 2: 316. 1880; Davy in Jepson, Fl. W. Mid. Cal. 64. 1901.

2. **B. maxima** L. Annual; culms erect or decumbent at base, 1 to 2 feet high; panicle drooping, few-flowered; spikelets ovate, large, ½ inch long or more, 5 lines broad, the pedicels slender, drooping; glumes and lemmas usually purple- or brown-margined.

A native of Europe, sparingly escaped from gardens where it is cultivated for ornament. Big Sur, *Davy* 7459.

Refs.—BRIZA MAXIMA L. Sp. Pl. 70. 1753; Davy in Jepson, Fl. W. Mid. Cal. 64. 1901.

3. **B. minor** L. Annual; culms erect, 4 to 15 inches high; panicle erect, pyramidal, many-flowered, the main branches stiffly ascending, the capillary branchlets spreading; spikelets triangular-ovate, 1½ lines long.

Naturalized from Europe, rather common from central California to British Columbia.

Refs.—BRIZA MINOR L. Sp. Pl. 70. 1753; Davy in Jepson, Fl. W. Mid. Cal. 64. 1901.

56. DACTYLIS L.

Spikelets 3 to 5-flowered, nearly sessile in dense fascicles, borne in panicles. Glumes unequal, keeled, acute, the first 1-nerved, the second 3-nerved. Lemmas 5-nerved, awn-pointed, compressed-keeled, the keels conspicuously ciliate-fringed. A perennial bunch-grass, with flat blades, and paniculate glomerules, the few branches expanded in flower.—Species 1, north temperate regions of the Old World. (Greek daktulos, a finger.)

1. **D. glomerata** L. ORCHARD GRASS. Culms erect, 2 to 4 feet high; blades broadly linear; panicle 3 to 6 inches long, the few stiff branches naked below, contracted after flowering; spikelets crowded in dense 1-sided clusters at the ends of the branches.

A native of Europe, commonly cultivated in the cooler regions of the U. S. as a meadow grass. Escaped from cultivation along roadsides and in waste places. Yreka, *Butler* 835; Scotia, *Davy & Blasdale* 5957; Bennett Valley, *Heller* 5657; Lake Tahoe, *McGregor* 199; San Bernardino, *Parish.*

Refs.—DACTYLIS GLOMERATA L. Sp. Pl. 71. 1753; Thurb. in Wats. Bot. Cal. 2: 301. 1880; Davy in Jepson, Fl. W. Mid. Cal. 65. 1901; Abrams, Fl. Los Ang. 48. 1904.

57. LAMARCKIA Moench.

Spikelets of 2 forms, in fascicles, the terminal one of each fascicle fertile, the others sterile. Fertile spikelet single, with 1 perfect floret, the rachilla produced beyond the floret into a slender stipe, bearing a small awned empty lemma, or reduced wholly to an awn. Glumes narrow, acuminate, or short-awned, 1-nerved. Lemma broader, 1-nerved, bearing below the apex a slender straight awn. Stamens 3. Sterile spikelets linear, 1 to 3 in each fascicle, consisting of 2 glumes similar to those of the fertile spikelet, and numerous, distichously imbricated, obtuse awnless empty lemmas. A low annual grass with elegant 1-sided narrow panicles of crowded fasciculate spikelets, the fertile spikelets being hidden, except the awns, by the numerous sterile ones.—Species 1, southern Europe, introduced in California. (Jean Baptiste Antoine Pierre Monnet, Chevalier de La Marck, the eminent French naturalist.)

1. **L. aurea** Moench. GOLDEN-TOP. Culms erect, or decumbent at base, 4 to 15 inches high; leaves smooth; ligule prominent, decurrent as a broad, scarious margin; panicle dense, 1 to 3 inches long, ½ to 1 inch wide, shining, golden-yellow or purplish, the branches close, short, erect; pedicels fascicled, somewhat clavate, pubescent, spreading at right angles, the fascicles with a tuft of long whitish hairs at the base; fertile spikelet about 1 line long, the sterile 3 to 4 lines long; glumes narrow, hyaline, 1 line long; lemmas awned from below the apex.

A native of the Mediterranean region, abundantly naturalized in southern California, rarer northward to Santa Clara Co.; also in northern Mexico.

Refs.—LAMARCKIA AUREA Moench, Meth. Pl. 201. 1794; Thurb. in Wats. Bot. Cal. 2: 299. 1880; Davy in Jepson, Fl. W. Mid. Cal. 65. 1901; Abrams, Fl. Los Ang. 49. 1904. *Cynosurus aureus* L. Sp. Pl. 72. 1753. *Achyrodes aureum* Kuntze, Rev. Gen. Pl. 2: 758. 1891.

58. POA L.

Spikelets 2 to several-flowered, the uppermost floret rudimentary, in open or narrow panicles. Glumes keeled, 1 to 3-nerved. Lemmas herbaceous or membranaceous, mostly scarious-tipped, acute or obtuse, keeled, awnless, 5-nerved, the intermediate nerves sometimes obscure, keel and marginal nerves sometimes villous, the floret sometimes with cobwebby hairs at base. Annuals or perennials with blades ending in a navicular point.—Species numerous, over 100, in the temperate and cool regions of both hemispheres. (Greek poa, grass or fodder.)

- Plants annual.
  - Lemmas villous on nerves below.
    - Panicle pyramidal, open; sheaths smooth. . . . . . . 1. *P. annua.*
    - Panicle narrow, contracted; sheaths scabrous..........................2. *P. bigelovii.*
  - Lemmas not villous on keel and nerves.
    - Sheaths rough; lemmas pubescent on back..........................3. *P. howellii*
    - Sheaths smooth; lemmas smooth or nearly so..........................4. *P. bolanderi.*
- Plants perennial.
  - Creeping rhizomes present.
    - Lemmas not webbed at base.
      - Glumes 4 lines long; spikelets about ½ inch long..................5. *P. macrantha.*

Glumes 1 to 2 lines long.
Panicles open; glumes 2 lines long........ ....6. *P. olneyae.*
Panicles almost spike-like; glumes 1 line long................7. *P. atropurpurea.*
Lemmas webbed at base, sometimes sparingly so.
Culm conspicuously flattened ....8. *P. compressa.*
Culm terete or nearly so.
Lemmas not pilose on keel or nerves.
Panicle contracted; web sparse ....9. *P. confinis.*
Panicle open; web abundant ....10. *P. kelloggii.*
Lemmas pilose on keel and usually also on marginal nerves.
Panicle dense and spike-like; plants dioecious................11. *P. douglasii.*
Panicle more or less open; plants not dioecious.
Lemmas 1½ lines long.... .. ..12. *P. pratensis.*
Lemmas 2½ lines long.................................13. *P. rhizomata.*
Creeping rhizomes absent.
Lemmas villous on keel and marginal nerves; blades firm, folded.
Ligule 2½ to 3½ lines long, acute...........................15. *P. longiligula.*
Ligule short, rounded or truncate............................14. *P. fendleriana.*
Lemmas sometimes pubescent near base but not villous on keel and marginal nerves.
Lemmas pubescent on lower part.
Blades filiform.
Panicle spike-like ....18. *P. nudata.*
Panicle loose and open.....................................19. *P. tenerrima.*
Blades narrow but not filiform.
Sheaths scabrous; panicle usually narrow. . ... 16. *P. scabrella.*
Sheaths smooth; panicle usually comparatively short and open.
Blades scattered along culm; culms loose and decumbent at base; spikelets 3 to 4 lines long..20. *P. alcea.*
Blades mostly basal.
Panicle open; culms decumbent at base.................21. *P. gracillima.*
Panicle contracted; culms erect........................17. *P. sandbergii.*
Lemmas smooth or scaberulous.
Panicle close and spike-like; plants of sea-side cliffs..........22. *P. unilateralis.*
Panicle more or less open.
Spikelets 1 or 2-flowered; panicle long, open...............23. *P. thurberiana.*
Spikelets 3 to several-flowered.
Blades filiform.
Blades smooth ....24. *P. hanseni.*
Blades scabrous ....25. *P. idahoensis.*
Blades narrow but not filiform.
Sheaths scabrous; panicle long, narrow..................26. *P. nevadensis.*
Sheaths smooth.
Panicle narrow, 4 to 8 inches long; culms 1½ to 3 feet high............. 27. *P. brachyglossa.*
Panicle short, 1 to 2 inches long; culms lower; blades involute, firm.
Lemmas about 3 lines long........................28. *P. pringlei.*
Lemmas 1½ to 2 lines long.
Culms 3 to 8 inches high; blades smooth ....29. *P. leibergii.*
Culms 1 to 2 feet high; blades scabrous.............30. *P. cottoni.*

1. **P. annua** L. Annual; culms flattened, decumbent at base, sometimes rooting at the lower nodes; sheaths loose; blades soft and lax; panicle pyramidal, open, 1 to 3 inches long; spikelets crowded, 3 to 6-flowered, about 2 lines long; lemma not webbed at base, distinctly 5-nerved, the nerves pilose on lower half.

Open ground, along roadsides and in waste places, throughout the state, except in the deserts; extends from Alaska to Mexico; introduced from Europe.

Refs.—POA ANNUA L. Sp. Pl. 68. 1753; Thurb. in Wats. Bot. Cal. 2: 311. 1880; Davy in Jepson, Fl. W. Mid. Cal. 66. 1901; Abrams, Fl. Los Ang. 45. 1904. *P. infirma* H. B. K. Nov. Gen. & Sp. 1: 158. 1816; Abrams, Fl. Los Ang. 50. 1904.

2. **P. bigelovii** Vasey & Scribn. Annual; culms erect, 6 to 15 inches high; panicle narrow, 3 to 6 inches long, the branches short, appressed; spikelets ovate, about 3 lines long; glumes acuminate, 3-nerved, 2 lines long; lemmas 2 lines long, webbed at base, copiously pilose on the lower part of the lateral nerves and keel, villous on lower portion of back between.

Open ground, southern California to western Texas, south into Mexico.

Locs.—Panamint Cañon, *Jones;* Los Angeles, *Davidson;* Colorado Desert, Coyote Cañon, *Hall* 2835; Palm Springs, *Parish* 6139; Laguna Mts., *Orcutt.*

Refs.—POA BIGELOVII Vasey & Scribn. in Vasey, Cat. Grasses U. S. 81. 1885. *P. annua* L. var. *stricta* Vasey, Bull. Torr. Club 10: 31. 1883.

3. **P. howellii** Vasey & Scribn. Annual; culms 1 to 3 feet high; sheaths retrorsely scabrous; panicle including ⅓ to ½ the plant, open, the branches in rather distant fascicles, spreading, scabrous, naked below, some short branches intermixed; spikelets 1½ to 2 lines long, usually 3 or 4-flowered; glumes narrow, acuminate, the first ¾ line long, 1-nerved or rarely 3-nerved, the second 1 line long, 3-nerved; lemmas webbed at base, 1 line long, ovate, pubescent over the lower ½ or ⅔, the nerves all rather distinct.

Rocky banks and shaded slopes, at moderate altitudes, mostly in the Coast Ranges; north to Vancouver Island. Two specimens from Yosemite Nat. Park (*Congdon, Chase* 5701) differ in having smooth sheaths and more or less 3-nerved first glume, and may prove to be a distinct species.

Refs.—POA HOWELLII Vasey & Scribn. U. S. Dept. Agr. Div. Bot. Bull. 13^2: pl. 78. 1893. Var. *microsperma* Vasey, Contr. Nat. Herb. 1: 273. 1893, type from Santa Cruz, *Anderson* 99.

4. **P. bolanderi** Vasey. Annual; culms erect, 6 inches to 2 feet high; sheaths smooth; panicle open, about ½ the length of the entire plant, the branches few and distant, smooth, stiffly spreading or somewhat reflexed, naked below; spikelets usually 2 or 3-flowered; glumes broad, the first 1-nerved, 1 line long, the second 3-nerved, 1½ lines long; lemma scantily webbed at base, smooth, scabrous on the keel, acute, the marginal nerves rather indistinct, the intermediate nerves obsolete.

Open ground or open woods, confined to the Sierra Nevada and high southern mountains; north to Washington, east to Alberta and Utah.

Locs.—Siskiyou Co., *Butler* 1747, 1750; Truckee Basin, *Davy* 3256; Tahoe, *Hitchcock* 3083; Mt. Tallac, *Hitchcock* 3156; Amador Co., *Hansen* 2081; Yosemite Nat. Park, *Hitchcock* 3255, 3308, 3315; Madera Co., *Congdon;* Bald Hill, *Leiberg* 5062; Pine Ridge, Fresno Co., *Hall & Chandler* 322; Sequoia Nat. Park and vicinity, *Culbertson* 4436, *Hall & Chandler* 432, *Hitchcock* 3367, 3391, 3466; San Jacinto Mts., *Reed* 2486.

Refs.—POA BOLANDERI Vasey, Bot. Gaz. 7: 32. 1882, type *Bolander* 6115 (from Ostrander's, Yosemite Park, acc. Bolander's Field Book). Var. *chandleri* Piper, Contr. Nat. Herb. 11: 132. 1906. *P. howellii* Vasey & Scribn. var. *chandleri* Davy, Univ. Cal. Publ. Bot. 1: 60. 1902, type from Schakelford Cañon, Marble Mt., *Chandler* 1703.

5. **P. macrantha** Vasey. Perennial from extensively creeping rhizomes; culms erect from a decumbent base, ½ to 1½ feet high, the sterile shoots widely spreading; sheaths smooth, tawny, and papery; blades smooth, involute, more or less curved or flexuous; panicle narrow, contracted, sometimes dense and spike-like, 2 to 5 inches long, pale or tawny; spikelets large, about ½ inch long, about 5-flowered; glumes smooth, 3-nerved, or the second indistinctly 5-nerved, about 4 lines long; lemmas 4 lines long, not webbed at base, short-pilose on the keel and marginal nerves below, slightly scabrous on

the keel above and sparingly on the back near margins; palea ciliate on keels.

Sand dunes along the coast, northern California to Washington. Crescent City, *Davy & Blasdale* 5966.

Ref.—POA MACRANTHA Vasey, Bull. Torr. Club 15: 11. 1888.

6. **P. olneyae** Piper. Perennial from creeping rhizomes; culms 1 to 2 feet high; sheaths smooth, or slightly scabrous; ligule about 1 line long; blades flat or folded, smooth on lower surface; panicle pyramidal, rather open, 1 to 4 inches long, the lower branches 2 or 3 in a cluster, about an inch long, ascending or spreading; glumes 2 lines long, acute; lemmas nearly smooth, sparingly pubescent or scaberulous on keel and marginal nerves, not webbed, the intermediate nerves faint.

Alpine meadows, open woods, and rocky banks in the Sierra Nevada and high southern mountains; north to British Columbia and east to Montana.

Locs.—Siskiyou Co., *Butler* 1318; Bierstadt Peak, *Davy* 3228 in part; Webber Lake, *Kennedy & Doten* 137; Truckee River, *Sonne* 4; Yosemite Nat. Park, *Hall & Babcock* 3538, 3567, *Hitchcock* 3278, 3319; Black Mts., *Hall & Chandler* 610; Sequoia Nat. Park, *Davidson* 2109, *Hitchcock* 3438; Griffin, Ventura Co., *Elmer* 3970; San Jacinto Mts., *Reed* 2496, *Wilder* 913; Fallbrook, *Jones* 3096.

Ref.—POA OLNEYAE Piper, Erythea 7: 101. 1899.

7. **P. atropurpurea** Scribn. Perennial from creeping rhizomes; culms 1 to 1½ feet high, slender; sheaths smooth; blades mostly basal, folded or involute, firm, smooth on under surface, the uppermost culm-leaf below the middle; panicle narrow, contracted, almost spike-like, purple-tinged, 1 to 2 inches long; spikelets 1½ to 2 lines long, turgid; glumes broad, less than 1 line long; lemmas a little over 1 line long, broad, smooth, not webbed, the nerves faint.

Only known from the San Bernardino Mts., *Parish* 2477, 2968, 3696.

Ref.—POA ATROPURPUREA Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 53. pl. 10. 1898, type *Parish* 2968.

8. **P. compressa** L. CANADA BLUEGRASS. Perennial from creeping rhizomes; culms not tufted, geniculate-ascending, flattened, wiry, bluish green, ½ to 1½ feet high; panicle narrow, 1 to 3 inches long, the usually short branches in pairs, spikelet-bearing to the base; spikelets crowded, subsessile, 3 to 6-flowered, 2 to 3 lines long; glumes about 1 line long, 3-nerved; lemmas firm, obscurely nerved, 1 to 1¼ lines long, sparingly webbed at base, short-pubescent below on keel and marginal nerves.

Open ground, open woods, meadows and waste places throughout the U. S., introduced from Europe. Distinguished from P. pratensis in gross appearance by the color and the scattered culms.

Ref.—POA COMPRESSA L. Sp. Pl. 69. 1753.

9. **P. confinis** Vasey. Perennial from creeping rhizomes; culms low, often geniculate or ascending at base, usually less than 6 inches high; sheaths and involute blades smooth; panicle narrow, contracted, ½ to 1 inch long, tawny; spikelets about 2 lines long; glumes unequal, the second 1½ lines long; lemmas 1½ lines long, scaberulous, sparsely webbed at base, the nerves faint.

Sand dunes and sandy meadows near the coast, Mendocino Co. (*Congdon*) to Alaska.

Ref.—POA CONFINIS Vasey, U. S. Dept. Agr. Div. Bot. Bull. 13^2: pl. 75. 1893.

10. **P. kelloggii** Vasey. Perennial from creeping rhizomes; culms 1 to 2 feet high, smooth, sheaths smooth, mostly basal; blades flat or folded, scabrous on upper surface; panicle pyramidal, open, 3 to 6 inches long, the branches mostly in 1's or 2's, slender, spreading or reflexed, bearing a few

spikelets toward the extremities; spikelets rather loosely flowered, 2 to 3 lines long; glumes 1 and 1½ lines long; lemmas acute or almost cuspidate, 1½ to 2 lines long, smooth, rather obscurely nerved, conspicuously webbed at base.

Coast Ranges from Humboldt Co. to Santa Cruz Co.

Locs.—Humboldt Bay, *Chandler* 1183; Mendocino, *Brown* 763; Comptche, *McMurphy* 476; Russian Gulch, *Davy* 6584; Santa Cruz Co., *Elmer* 5029.

Ref. POA KELLOGGII Vasey, U. S. Dept. Agr. Div. Bot. Bull. 13^{2}: pl. 79. 1893, type *Bolander* 4705 (from Mendocino Co. acc. Bolander's Field Book).

11. **P. douglasii** Nees. Perennial from extensively creeping rhizomes; culms ascending from a decumbent base, usually less than a foot high; sheaths smooth, tawny and papery; blades involute, some of these usually exceeding the culm; panicles dioecious, ovoid or oblong, dense and spike-like, 1 to 2 inches long, ¾ inch wide, pale or tawny; spikelets 3 to 5 lines long, about 5-flowered; glumes broad, 3-nerved, smooth, scabrous on upper part of keel, nearly equal, 2 to 3 lines long; lemmas 3 lines long, slightly webbed at base, villous on the lower part of keel and marginal nerves, scabrous on keel above, 1 to 3 pairs of indistinct intermediate nerves; palea ciliate on keels.

Sand dunes near the coast, Pt. Arena to Monterey.

Locs.—Pt. Arena, *Davy & Blasdale* 6045; Bodega Bay, *Heller* 5187; Pt. Reyes, *Davy* 6742; San Francisco, *Bolander* 1528, 6074, *Piper* 6223; Oakland, *Jones* 3258; Santa Cruz, *Anderson;* Monterey and vicinity, *Chase* 5655, *Davy* 7291, *Hitchcock* 2596.

Refs.—POA DOUGLASII Nees, Ann. Nat. Hist. 1: 284. 1838; Thurb. in Wats. Bot. Cal. 2: 314. 1880; Davy in Jepson, Fl. W. Mid. Cal. 66. 1901.

12. **P. pratensis** L. KENTUCKY BLUEGRASS. Perennial from creeping rhizomes; culms tufted, 1 to 3 feet high, terete or slightly flattened; sheaths smooth compressed; ligule about 1 line long; blades soft, flat or folded, the basal often elongated; panicle pyramidal, open, the slender branches in remote fascicles of 3 to 5, ascending or spreading, naked at base, some of them short; spikelets crowded, 3 to 5-flowered, 2 to 2½ lines long; lemmas 1½ lines long, copiously webbed at base, silky-pubescent on the keel and marginal nerves, the intermediate nerves prominent.

Open woods, banks, open ground, except in the deserts; extends throughout the northern part of North America and Eurasia; extensively cultivated as a pasture and lawn grass. Some forms are clearly native in the mountains, while other forms, especially at low altitudes are escaped from cultivation.

Refs.—POA PRATENSIS L. Sp. Pl. 67. 1753; Thurb. in Wats. Bot. Cal. 2: 312. 1880; Davy in Jepson, Fl. W. Mid. Cal. 66. 1901; Abrams, Fl. Los Ang. 50. 1904.

P. TRIVIALIS L. is mentioned by Thurber (Wats. Bot. Cal. 2: 313. 1880) as being introduced along the Coast Ranges.

13. **P. rhizomata** Hitchc. n. sp. Perennial from creeping rhizomes; culms erect, 1 to 2 feet high, smooth; sheaths smooth, the lower loose and papery; ligule 1 to 1½ lines long; blades flat or folded, ½ to 1 line wide, 1 to 3 inches long, the culm blades about 2, the upper erect, about 1 inch long; panicle long-exserted, oblong, contracted, 1 to 2 inches long, the branches short, slender, mostly in 2's, ascending, few-flowered; spikelets about 3 lines long, 3 to 5-flowered; glumes unequal, rather broad, acute, scabrous on the keels, the first 1-nerved, 1½ lines long, the second 3-nerved, 2 lines long; lemmas 2½ lines long, acutish, copiously webbed at base, short-pilose on keel below, and sparingly so on lower part of marginal nerves, the intermediate nerves faint, sparingly scabrous between the nerves; palea ciliate on the keels.—(Perennis e rhizomatibus repentibus; culmi recti, 1-2 ped. alti, glabri; vaginae glabrae;

ligula 1-1½ lin. longa; laminae planae vel conduplicatae, ½-1 lin. latae, 1-3 pol. longae, caulinae plerumque 2; panicula oblonga, coarctata, 1-2 pol. longa, ramis brevibus, tenuibus, ascendentibus, paucifloris; spiculae circa 3 lin. longae, 3-5 florae; glumae inaequales, latisculae, acutae, carinis scabrae, prima 1-nervia, 1½ lin. longa, altera 3-nervia, 2 lin. lata; lemmata 2½ lin. longa, subacuta, basi valde villosa inter nervos scabra, carina nervisque marginalibus prope basin breviter pilosis, nervis intermediis obscuris; palea carinis ciliatis.)

Type specimen, *Butler* 1205, Oro Fino, Siskiyou Co., in damp shady woods, Apr. 21, 1910. The only other specimens seen from California are *Butler* 1206 from Siskiyou Co., and *Hatton* 43 from Modoc National Forest. The species also occurs in Idaho (Beaver Cañon, *Shear* 297). The above description is drawn from the type specimen in the National Herbarium.

14. **P. fendleriana** Vasey. Tufted perennial; culms erect, smooth, seabrous below panicle, 1 to 1½ feet high; sheaths somewhat scabrous; ligule less than ½ line long; blades mostly basal, involute or folded, scabrous, firm; panicle long exserted, narrow, contracted, 1 to 3 inches long; glumes broad, 1½ lines long, the first 1 nerved; lemmas 2 lines long, long-pilose on the lower portion of keel and marginal nerves, the intermediate nerves obscure.

Mesas and hills, Great Basin from Washington to Wyoming, south to New Mexico and southern California. Panamint, *Hall & Chandler* 7009; San Bernardino Mts., *Parish* 3307.

Refs.—POA FENDLERIANA Vasey, U. S. Dept. Agr. Div. Bot. Bull. 13^2: pl. 74. 1893; Williams, U. S. Dept. Agr. Div. Agrost. Circ. 10: 5. 1899; Abrams, Fl. Los Ang. 50. 1904. *Eragrostis fendleriana* Steud. Syn. Pl. Glum. 1: 278. 1854. *Atropis californica* Munro; Thurb. in Wats. Bot. Cal. 2: 309. 1880.

15. **P. longiligula** Scribn. & Williams. Tufted perennial, similar to P. fendleriana; culms smooth, 1 to 2 feet high; sheaths and blades smooth; ligule 2½ to 3½ lines long, or on the innovations somewhat shorter; panicle looser and often longer; spikelets as in P. fendleriana.

Cañons and banks of streams, San Bernardino Mts. and from Montana to New Mexico. San Bernardino Mts., *Parish* 5043, 5045; Mt. Davidson, *Bloomer* 2269; Grayback Mt., *Reed* 2768.

Refs.—POA LONGILIGULA Scribn. & Williams, U. S. Dept. Agr. Div. Agrost. Circ. 9: 3. 1899; Williams, U. S. Dept. Agr. Div. Agrost. Circ. 10: 3. 1899.

16. **P. scabrella** Benth. Tufted perennial; culms erect, 2 to 3 feet high, usually scabrous, at least below panicle; sheaths scabrous; ligule rather long; blades mostly basal, flat, narrow, usually about ½ line wide, lax, more or less scabrous; panicle narrow, usually contracted, sometimes rather open at base, 2 to 5 inches long; spikelets narrow, 3 to 5 lines long; glumes scabrous, 1½ lines long; lemmas 2 lines long, puberulent or scabrous on back, and more or less crisp-pubescent at base.

A common species throughout the state in meadows, woods, rocks and hills, and extending into Oregon, Nevada, Arizona and Mexico. As here limited the species includes a number of rather diverse forms which with our present knowledge can not be satisfactorily separated into distinct species. The following are some of the numbered specimens referred to this species: *Abrams* 1162, 1475, 3105, *Bolander* 1547, 1550, *Brewer* 233, 1024, 1122, *Davy* 6650, *Hall* 1439, 1661, 2064, 2973, 2974, 3089, 6360, 7811, *Heller* 5245, 5249, 7584, 8007, 8038, 8188, 8267, 8304, 8706, *Hitchcock* 2725, 3320, 3328, 3329, *Jepson* 4241, *Parish* 1548, 3304, 3348, 5044, *Parish Bros.*, 1641. The following have an unusually open panicle: Santa Barbara, *Elmer* 4153; Ventura, *Hubby* 25.

Refs.—POA SCABRELLA Benth.: Vasey, Grasses U. S. 42. 1883; Abrams, Fl. Los Ang. 51. 1904. *Atropis scabrella* Thurb. in Wats. Bot. Cal. 2: 310. 1880, type from Oakland, *Bolander*. *Poa orcuttiana* Vasey, W. Am. Sci. 3: 165. 1887, type from San Diego, *Orcutt*. *P. limosa* Scribn. & Williams, U. S. Dept. Agr. Div. Agrost. Circ. 9: 5. 1899, type from Mono Lake, *Bolander*. The species of this group require careful monographic study. *Poa secunda* Presl (Rel. Haenk. 1: 271. 1830), from Chile appears to belong to this species, and, if so, the name must be taken up as has been done by Davy (Jepson, Fl. W. Mid. Cal. 67. 1901. See also, Scribn. Rep. Mo. Bot. Gard. 10: 51. pl. 51. 1899). *P. buckleyana* Nash (Bull. Torr. Club 22: 465. 1895; *P. tenuifolia* Buckl. Proc. Acad. Phila. 1862: 96. 1863, not A. Rich. 1851) is probably also a synonym.

17. **P. sandbergii** Vasey. Similar to P. scabrella; differing in being smooth, averaging lower and more slender, the panicle smaller, the blades short and soft, often involute.

Plains and dry or rocky woods from Ventura and San Bernardino cos. north to British Columbia and east to Wyoming. Specimens intermediate between this species and P. scabrella occur.

Refs.—POA SANDBERGII Vasey, Contr. Nat. Herb. 1: 276. 1893. *Atropis tenuifolia* Thurb. in Wats. Bot. Cal. 2: 310. 1880, mainly as to description but the name is based on *Poa tenuifolia* Buckl.

18. **P. nudata** Scribn. Differs from P. scabrella in having a close and spike-like panicle, nearly naked culms, and capillary blades.

Only known from the type specimen, collected at Potrero, San Diego Co., in 1892, the collector unknown.

Refs.—POA NUDATA Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 9: 1. 1899. *P. capillaris* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 51. 1898, not L., type from Potrero.

19. **P. tenerrima** Scribn. Differs from P. scabrella in having a much more open panicle, with spreading branches; blades capillary; ligule short.—Known only from the type specimen, which was sent to Prof. Scribner from the California Academy of Sciences, without data as to locality or collector.

Ref.—POA TENERRIMA Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 9: 4. 1899.

20. **P. alcea** Piper. Tufted perennial; culms slender, 2 to 3 feet high, loose and decumbent at base; sheaths smooth or somewhat scabrous, loose and papery at base; ligule long; blades flat, rather soft, more or less scabrous; panicle loose and open, the branches 1 to 2 inches long, ascending; spikelets 3 to 4 lines long, tawny; glumes smooth, the second 2 lines long; lemmas about 2 lines long, puberulent at base, the nerves not prominent.

Wet rocks and rocky banks, Mendocino Co. (Sherwood, *Hitchcock* 2714); also in Oregon. A specimen from Palm Springs (*Parish* 6141) is tentatively referred to this species but it is far out of the known range.

Ref.—POA ALCEA Piper, Bull. Torr. Club 32: 436. 1905.

21. **P. gracillima** Vasey. Tufted perennial; culms 1 to 2 feet high, erect from usually a decumbent base; sheaths smooth; ligule 1½ lines long; blades flat or folded, lax, smooth, mostly basal; panicle pyramidal, loose, rather open, 2 to 4 inches long, the branches in whorls, the lower 2 to 6, 1 to 3 inches long, slender, spreading or sometimes reflexed, naked below; spikelets 2 to 3 lines long; glumes smooth, the second 1½ to 2 lines long; lemmas about as long as second glume, minutely scabrous, crisp-pubescent near base, especially on the nerves.

Rocky woods or gravelly soil, in the Sierra Nevada from Nevada Co. (*Torrey* 572) to Sequoia Nat. Park (*Hall & Babcock* 5540); Oregon to British Columbia. Two specimens with smooth lemmas are referred here, Nacimiento River, Monterey Co., *Davy* 7673 and Ebbetts Pass, *Brewer* 2077. The former is out of range and may belong to a different species.

Refs.—Poa gracillima Vasey, Contr. Nat. Herb. 1: 272. 1893. *P. invaginata* Scribn. & Williams, U. S. Dept. Agr. Div. Agrost. Circ. 9: 6. 1899, type from "Summit Camp, Sierra Nevada, July 10, 1870."

22. **P. unilateralis** Scribn. Tufted perennial; culms 4 to 15 inches high; sheaths smooth, tawny and papery; blades flat or folded, shorter than the culms; panicle oblong, dense and spike like, or somewhat interrupted below, 1 to 3 inches long; spikelets 3 to 4 lines long, perfect; glumes broad, acute, smooth, indistinctly scabrous on keel near apex, the first 1-nerved or indistinctly 3-nerved, the second 3-nerved; lemmas 2 lines long, not webbed at base or pilose, scabrous on base of marginal nerves and apex of keel, the intermediate nerves faint; palea ciliate on keels.

Cliffs, bluffs and rocky meadows near the seashore, Humboldt Co. to Monterey.

Locs.—Humboldt Bay, *Chandler* 1140; Mendocino, *McMurphy* 399; Pt. Arena, *Davy & Blasdale* 6024; Bodega Bay, *Heller* 5279; Pt. Reyes, *Davy* 6765, 6804, 6881; San Francisco, *Abrams* 1599; Montara Pt., *Copeland* 3306; Santa Cruz, *Anderson;* Monterey and vicinity, *Davy* 7293, *Heller* 6702.

Refs.—Poa unilateralis Scribn.; Vasey, U. S. Dept. Agr. Div. Bot. Bull. 13^2: pl. 85. 1893, type from San Francisco, *Jones* 15 in 1882; Davy in Jepson, Fl. W. Mid. Cal. 67. 1901. *Atropis procumbens* Thurb. in Wats. Bot. Cal. 2: 309. 1880. This name is based on *Poa procumbens* Curt. but the specimen in the Gray Herbarium (*Bolander* 6467, seashore at Fort Bragg, Mendocino Co.) cited by Thurber, consists mostly of *Poa unilateralis* and this is the species described. But mounted with this is a fragment of *Sclerochloa procumbens* Beauv. It is not impossible that this fragment may have been detached from a European specimen by Dr. Thurber, for comparison with the Bolander specimen and not afterwards removed. *Sclerochloa procumbens* is not known to grow on the Pacific Coast.

23. **P. thurberiana** Vasey. Tufted perennial; culms 2 to 3 feet high, smooth; sheaths somewhat scabrous, the basal smooth and papery; ligule 1 to 2 lines long; blades narrow, involute, scabrous; panicle narrow, 8 to 10 inches long, loose, the branches long, ascending; spikelets 2 lines long, 1 or 2-flowered; glumes 1½ lines long, 3-nerved; lemmas 1½ lines long, scaberulous, not pilose or webbed.

Little known. Aside from the type collection by Lemmon, in Sierra Valley, this species was collected by Bolander (Los Angeles?) and what appears to be the same species by Chase at Santa Barbara (no. 5604).

Refs.—Poa thurberiana Vasey, U. S. Dept. Agr. Div. Bot. Bull. 13^2: pl. 84. 1893. *Panicularia thurberiana* Kuntze, Rev. Gen. Pl. 2: 783. 1891. *Atropis pauciflora* Thurb. in Wats. Bot. Cal. 2: 310. 1880 (type from Sierra Valley, *Lemmon*), not *Poa pauciflora* Roem. & Schult. 1817.

24. **P. hanseni** Scribn. Tufted perennial; culms erect, slender, 6 to 8 inches high or sometimes taller, smooth; sheaths smooth; ligule ½ to 1 line long; blades capillary, involute, smooth, mostly basal; panicle narrow, 1 to 2 inches long; spikelets 2 to 3 lines long; glumes 1½ to 2 lines long; lemmas scaberulous but not pilose or webbed.—Differs from P. pringlei in being more delicate and in having smaller spikelets.

A little known species from isolated localities in California. Modoc Nat. For., *Hatton* 63; Plumas Co., *Heller* 8751; Tuolumne Meadows, *Hall & Babcock* 3627 in part; Loma Prieta, *Davy* 534.

Ref.—Poa hanseni Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 53. pl. 9. 1898, type from Silver Lake, Amador Co., *Hansen* 605.

25. **P. idahoensis** Beal. Tufted perennial; culms slender, 6 to 18 inches high, smooth, slightly scabrous below the panicle; sheaths loose and papery, smooth; blades capillary, soft, scabrous, the basal as much as 10 inches long; panicle narrow, contracted but loose, 1 to 2 inches long; spikelets 2½ to 3 lines

long; glumes broad, scarious-margined, about 1½ lines long; lemmas about 2 lines long, minutely scabrous, not webbed at base or pilose.

Washington to Idaho and California. The only specimen observed from California is *Hansen* no. 2614, without locality but probably Amador Co.

Refs.—Poa idahoensis Beal, Grasses N. Am. 2: 539. 1896. *P. filifolia* Vasey, Contr. Nat. Herb. 1: 271. 1893, not Schur. 1866. *P. scabrifolia* Heller, Bull. Torr. Club 24: 310. 1897, based on *P. filifolia* Vasey. *P. spillmani* Piper, Erythea 7: 102. 1899. *P. capillarifolia* Scribn. & Williams, U. S. Dept. Agr. Div. Agrost. Circ. 9: 1. 1899, type *Hansen* 2614.

26. **P. nevadensis** Vasey. Tufted perennial; culms 1½ to 3 feet high, smooth; sheaths scabrous; ligule 2 lines long, decurrent; blades firm, involute, scabrous; panicle narrow, 4 to 6 inches long; spikelets 3 to 4 lines long, narrow; glumes narrow, the second 1½ lines long; lemmas smooth or scaberulous, not pilose or webbed, 1½ lines long.

Plains and dry meadows; San Bernardino and Los Angeles cos., through eastern California to Wyoming and Colorado.

Locs.—Siskiyou Co., *Heller* 8070; Moulton, *Griffiths & Hunter* 463; Honey Lake Valley, *Davy* 3305, 3319; Chat, *Jones;* Sierra Valley, *Lemmon* 4672, 5461; Mt. Tallac, *Hitchcock* 3117; Ebbetts Pass, *Brewer* 1999; Bishop, *Heller* 8354; Antelope Valley, *Davy* 2246; Mohave Desert, *Parish* 4888; San Bernardino Mts., *Parish Bros.* 1543.

Ref.—Poa nevadensis Vasey; Scribn. Bull. Torr. Club 10: 66. 1883.

27. **P. brachyglossa** Piper. Tufted perennial; culms glabrous, 1½ to 3 feet high; sheaths smooth; ligule of the culm leaves about 1 line long; blades stiff and firm, flat or involute; panicle narrow, 4 to 8 inches long, the branches ascending; spikelets 4 to 5 lines long; glumes smooth, 2 to 2½ lines long; lemmas smooth or nearly so, firm.

Dry slopes and cliffs, British Columbia to Utah and northern California. Klamath River, *Butler* 467; Lassen Co., *Davy, Baker & Nutting;* Mt. Lola, *Kennedy & Doten* 182.

Ref.—Poa brachyglossa Piper, Proc. Biol. Soc. Wash. 18: 145. 1905.

28. **P. pringlei** Scribn. Tufted perennial; culms 4 to 10 inches high, the base sometimes decumbent and rhizome-like; sheaths smooth, loose and papery; blades mostly basal, involute, usually not over 1 or 2 inches long, smooth, the uppermost culm blade at or below the middle; panicle narrow, contracted, few flowered; spikelets 3 to 4 lines long, about 3-flowered; glumes equal, broad, 3-nerved, 2 to 3 lines long; lemmas 2½ to 3 lines long, smooth or scabrous, not webbed or pilose.

High mountains of California.

Locs.—Mt. Shasta, *Copeland* 3894, *Goodale, Jepson;* head of Trinity River, *Pringle;* Mt. Stanford, *Sonne* 15; Donner Pass, *Heller* 7157; Butte Co., *Austin* 118; Mt. Goddard, *Hall & Chandler* 691; Mt. Tallac, *Hitchcock* 3151; Castle Peak, *Leiberg* 5303; Tuolumne Meadows, *McLean;* Farewell Gap, *Purpus* 5207; Mt. Whitney, *Coville & Funston* 2066; Mt. Pinos, *Hall* 6546.

Ref.—Poa pringlei Scribn. Bull. Torr. Club 10: 31. 1883, type from headwaters of Sacramento River, *Pringle* in 1882.

29. **P. leibergii** Scribn. Tufted perennial; culms 3 to 8 inches high; sheaths smooth; ligule about 1 line long; blades mostly basal, firm, involute, smooth, short; panicle narrow, 1 to 2 inches long, usually purple, the branches short, appressed; spikelets 2 to 3 lines long; glumes 1½ to 2 lines long; lemmas 1½ lines long, smooth or scaberulous, not webbed or pilose, the nerves obscure.—Differs from P. pringlei in the smaller spikelets; from P. hanseni in the smooth and firmer blades.

Alpine meadows and sterile gravelly alpine flats, high Sierra Nevada at about

12,000 feet altitude: Mt. Lyell, *Hitchcock* 3294, 3296, 3300, 3302; Lyell Fork Cañon, *Hitchcock* 3290; Siberian Outpost, *Hitchcock* 3436, 3451, 3452. The type, from southeastern Oregon, is the only other collection known.

Ref.—POA LEIBERGII Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 8: 6. pl. 2. 1897.

30. **P. cottoni** Piper. Tufted perennial; culms erect, smooth, scabrous below panicle, 1 to 2 feet high; sheaths smooth or slightly scabrous; ligule less than ½ line long; blades involute, erect, scabrous; panicle long-exserted, oblong, contracted, sometimes almost spike-like, 1 to 2 inches long; spikelets about 3 lines long; glumes broad, smooth, scarcely scabrous on the keel, the first 1½ lines long, the second a little longer; lemmas 2 lines long, smooth or minutely scabrous, not webbed at base, nerves all prominent.

Rocky woods, and along mountain streams, high Sierra Nevada, north to Washington.

Locs.—Pine Creek, *Baker & Nutting, Davy;* Nevada Co., *Sonne;* Sierra Valley, *Lemmon* 5463; Lake Tahoe, *Hitchcock* 3154, *Reed & Pendleton* 1624; Mt. Lyell, *Hitchcock* 3298; Farewell Gap, *Hitchcock* 3386; Mt. Whitney, *Hitchcock* 3449.

Ref.—POA COTTONI Piper, Proc. Biol. Soc. Wash. 18: 146. 1905.

59. GLYCERIA R. Br.

Spikelets few to many flowered, subterete or slightly compressed, in narrow or spreading panicles. Glumes unequal, short, obtuse or acute. Lemmas convex, firm with a scarious margin or apex, usually obtuse, awnless, 5 to 9-nerved, the nerves usually prominent. Usually tall aquatic perennials. Species about 16, temperate regions of both hemispheres. (Greek glukeros, sweet.)

Spikelets linear, over 5 lines long.
  Lemmas about 2½ lines long..........1. *G. plicata.*
  Lemmas about 1¾ lines long.
    Spikelets about ½ line wide, green; lemmas smooth or minutely scabrous on the nerves... 2. *G. borealis.*
    Spikelets about 1 line wide, purplish tinged; lemmas scabrous on the nerves and somewhat so between them..........3. *G. leptostachya.*
Spikelets ovate or oblong, not over 2½ lines long.
  Lemmas with 5 prominent nerves.
    Panicle ovate or pyramidal, open..........4. *G. pauciflora.*
    Panicle narrow, branches ascending..........5. *G. erecta.*
  Lemmas with 7 prominent nerves..........6. *G. elata.*

1. **G. plicata** Fries. Culms ascending from a decumbent rooting base, rather thick and succulent, 4 to 5 feet tall; sheaths smooth; blades 1½ to 5 lines wide, scabrous above; panicle long and narrow; glumes very unequal, obtuse, the second 1½ lines long; lemmas purple tinged, broad, obtuse, 2½ lines long, prominently 7-nerved, with an additional short pair near the margin, very scabrous on the nerves and somewhat so between them; palea about as long as lemma.

In shallow water, Mendocino Co. (Sherwood, *Davy* 5183, *Hitchcock* 2710; Walker Valley, *Davy & Blasdale* 5083); Oregon to Vancouver Island.

Ref.—GLYCERIA PLICATA Fries, Mant. 3: 176. 1842.

2. **G. borealis** Batchelder. Culms 2 to 3 feet high, erect from a more or less decumbent and rooting base; sheaths smooth or slightly scabrous, keeled; blades flat or usually folded, scabrous above, erect, 1½ to 2 lines wide; panicle long and narrow, the branches and slender pedicels appressed; spikelets narrow, nearly terete, ½ to ¾ inch long, ½ line wide, pale, not purple-tinged; glumes 1 nerved, the first ¾ line, the second 1½ lines long; lemmas oblong, 2 lines long, 7-nerved, smooth or indistinctly scabrous on the nerves.

Jepson, Fl. Cal. vol. 1 (Gramineae by Hitchcock, pp. 82-160, Apr. 22, 1912).

In shallow water, central and northern California; eastward to Colorado, New Brunswick and Connecticut.

Locs.—Mt. Shasta, *Palmer* 2614 in 1892; Warner Mts., *Griffiths & Hunter* 452; Tahoe, *Hitchcock* 3102; Placer Co., *Carpenter;* Petaluma, *Elmer* 4652; Yosemite Valley, *Hitchcock* 3237.

Refs.—GLYCERIA BOREALIS Batchelder, Proc. Manchester Inst. Arts & Sci. 1: 74. 1900. *Panicularia borealis* Nash, Bull. Torr. Club 24: 348. 1897. *Glyceria fluitans* [R. Br. misapplied by] Thurb. in Wats. Bot. Cal. 2: 307. 1880; the preceding and following species are also probably included.

3. **G. leptostachya** Buckl. Culms about 4 feet high; sheaths smooth; blades minutely and sparsely scabrous above, about 2 lines wide; panicle long and narrow; spikelets ½ to ¾ inch long, about 1 line wide; lemma oblong, truncate, more or less purple-tinged, about 1½ lines long, prominently 7-nerved, distinctly scabrous on and between the nerves.

In shallow water, Sonoma Co. (Guerneville, *Davy* 6005; Sonoma, *Heller* 5606). Also in Oregon.

Refs.—GLYCERIA LEPTOSTACHYA Buckl. Proc. Acad. Phila. 1862: 95. 1862. *Panicularia davyi* Merr. Rhodora 4: 145. 1902, type *Davy* 6005.

4. **G. pauciflora** Presl. Culms 1 to 4 feet high, from a decumbent rooting base, with creeping rhizomes; sheaths smooth or scabrous; blades scattered, 3 to 6 lines wide, scabrous; panicle pyramidal, nodding, 4 to 8 inches long, open, the branches spreading, naked below, rather densely flowered toward the ends; spikelets about 2 lines long, oblong, about 5-flowered; glumes short, broad, obtuse, ½ and ¾ line long; lemmas 1 line long, oblong, rounded and somewhat erose at summit, prominently 5-nerved, very scabrous on the nerves and somewhat so between.

Swamps, shallow water and wet meadows; Kern Cañon (*Hitchcock* 3421) northward in the Sierra Nevada, and San Francisco (*Davy* 728) northward along the coast to British Columbia; east to Montana and Colorado.

Refs.—GLYCERIA PAUCIFLORA Presl, Rel. Haenk. 1: 257. 1830; Thurb. in Wats. Bot. Cal. 2: 308. 1880. *Panicularia pauciflora* Kuntze, Rev. Gen. Pl. 2: 783. 1891; Davy in Jepson, Fl. W. Mid. Cal. 68. 1901. *P. multifolia* Elmer, Bot. Gaz. 36: 54. 1903.

5. **G. erecta** Hitchc. n. sp. Culms slender, 1 to 2 feet high, erect from a decumbent rooting base, with creeping rhizomes; sheaths smooth, numerous and overlapping at base, the ligule broad and scarious, 1½ to 2 lines long; blades mostly basal, short and erect, flat, 2 to 3 lines wide, scabrous on both surfaces or nearly smooth; panicle long-exserted, narrow, 2 to 3 inches long, the short branches ascending; spikelets oblong, 2½ to 3 lines long, pale or purple-tinged, 4 to 6-flowered; glumes broad, obtuse, 1-nerved, the first about ½, the second about 1 line long; lemmas about 1¼ lines long, smooth, distinctly but not prominently 5-nerved, the apex scarious, erose-toothed; palea about as long as lemma.—(Culmi tenues recti, ad basin decumbentes, e rhizomatibus repentibus; vaginae numerosae deorsum imbricatae; ligula 1½-2 lin. longa; laminae breves, rectae, planae, 2-3 lin. latae, scabrae; panicula angusta, 2-3 pol. longa, ramis brevibus, ascendentibus; spiculae oblongae, 2½-3 lin. longae, 4-6-florae; glumae latae, obtusae, 1-nerviae, prima ½ lin. altera 1 lin. longa; lemmata circa 1½ lin. longa, levigata, 5-nervia apice scariosa erosaque; palea lemmate subaequilonga.)

Springy places in mountain meadows, Sierra Nevada to southern Oregon.

Type: *Hitchcock* 3250½ in the National Herbarium, Sunrise Creek, Yosemite National Park, August 19, 1908. In California this species has been collected at: Summit Valley, *Pringle* in 1882; Mt. Tallac, *Hitchcock* 3157; Yosemite Nat. Park, *Hitchcock* 3223, 3250½; Northfork, *Griffiths* 6647, 6649, Madera Co., *Congdon*; Hockett Meadow, *Hitchcock* 3468; Farewell Gap, *Purpus* 5151; Whitney Meadows, *Coville & Funston* 1676. In Nevada at Glenbrook, Lake Tahoe (*Hitchcock* 3198, 3205). In Oregon in the Crater Lake region (*Coville & Leiberg* 392, *Coville* 1458, *Hitchcock* 3044, 3059).

6. **G. elata** Hitchc. n. comb. Culms erect, smooth, succulent, 3 to 6 feet high; sheaths scabrous; blades flat, usually 3 to 5 lines or sometimes only 2 lines wide, scabrous; panicle large and diffuse, becoming oblong, 6 to 12 inches long, the branches naked below, the lower usually reflexed at maturity; spikelets 1½ to 2½ lines long, oblong or ovate-oblong, usually 6 to 8-flowered; glumes broad, obtuse, much shorter than the lower lemmas, nerveless, the first about ½ line long; lemmas firm, obovoid, obtuse or acutish, prominently 7-nerved.—This may be only a form of G. nervata Willd., but the California specimens differ from the eastern and northern representatives of that species in being taller and more succulent, and in having wider blades, more oblong panicle with the lower branches often reflexed, and larger spikelets.

Wet meadows, springs, and shady moist soil in woods, in the Coast Ranges to the Bay region, in the Sierra Nevada, and the high southern mountains; north to British Columbia and east to Idaho.

Refs.—GLYCERIA ELATA Hitchc. *Panicularia elata* Nash, in Rydb. Mem. N. Y. Bot. Gard. 1: 54. 1900. *P. nervata elata* Piper, Contr. Nat. Herb. 11: 140. 1906. *Glyceria nervata* [as misapplied by] Thurb. in Wats. Bot. Cal. 2: 307. 1880.

60. PUCCINELLIA Parl.

Spikelets several-flowered, terete, in open or narrow panicles. Glumes unequal, short. Lemmas rounded on the back, obtuse, firm, obscurely nerved. Perennial grasses with pale spikelets; growing along the seacoast or in alkaline soil, differing from Panicularia chiefly in the obscurely nerved lemmas.—Species 14, in northern extratropical regions of both hemispheres. (Prof. Benedetto Puccinelli, an Italian botanist.)

Panicle open, the branches spreading.
  Leaves mostly in a short radical cluster; panicle usually less than 4 inches long.........1. *P. lemmoni.*
  Leaves scattered; panicle usually more than 4 inches long...............2. *P. nuttalliana.*
Panicle narrow, the branches ascending or appressed.
  Panicle branches long, ascending; plant stout, 1½ to 2 feet high.....3. *P. festucaeformis.*
  Panicle strict, the branches short and appressed; plants lower.
    Blades involute; culms about 1 foot high..................4. *P. angustata.*
    Blades flat, soft and lax; culms 3 to 8 inches high..................5. *P. simplex.*

1. **P. lemmoni** Scribn. Culms slender, 6 to 15 inches high; blades short, filiform, mostly basal, smooth, involute; panicle 2 to 4 inches long, becoming open, the branches spreading; spikelets 2½ to 3 lines long; glumes 1-nerved, 1 and 1½ lines long; lemmas 1½ lines long, smooth.

Alkaline soil, in the northern Sierra Nevada (Sierra Valley, *Bolander*). Nevada to Assiniboia.

Refs.—PUCCINELLIA LEMMONI Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 17: 276. f. 572. 1899. *Poa lemmoni* Vasey, Bot. Gaz. 3: 13. 1878, type from Sierra Co., *Lemmon*. This and several other species are included under *Atropis distans* by Thurber (Wats. Bot. Cal. 2: 308. 1880).

2. **P. nuttalliana** Hitchc. n. comb. Culms tufted, erect, 1½ to 2 feet high; sheaths and involute blades smooth; panicle open, 6 to 8 inches long, the branches spreading, naked below; spikelets terete, about 3 lines long, usually pale; glumes acutish, the first 1-nerved, ½ line long, the second 3-nerved, 1 line long; lemmas about 1½ lines long, sparsely pubescent at base.

Alkaline soil, Dakotas to California and Texas.

Locs.—Warner Mts., *Griffiths & Hunter* 390; Honey Lake Valley, *Davy;* Livermore Pass, *Davy;* Ft. Tejon, *Davy* 2367; Santa Ana, *Bradshaw;* San Bernardino Mts., *Parish Bros.* 1559; San Diego, *G. R. Vasey.*

Refs.—PUCCINELLIA NUTTALLIANA Hitchc. *Poa nuttalliana* Schult. Mant. 2: 303. 1824, based on *Poa airoides* Nutt. *Puccinellia airoides* Wats. & Coult. in Gray, Man. ed. 6. 668. 1890. *Poa airoides* Nutt. Gen. Pl. 1: 68. 1818, not Koeler, 1802.

3. **P. festucaeformis** Parl. Culms in small tufts, rather stout, $1\frac{1}{2}$ to 2 feet high; leaves scattered, smooth, the blades loosely involute, more or less spreading; panicle narrow, 4 to 6 inches long, the branches appressed, the lower as much as 3 inches long; spikelets about 4 lines long; glumes nearly equal, 3-nerved, narrow, about $1\frac{1}{2}$ lines long; lemmas 2 lines long, smooth.

Saline soil near the coast, California to Alaska. Pt. Reyes, *Davy* 6749; San Mateo Co., *Jaffa* in 1900.

Refs.—PUCCINELLIA FESTUCAEFORMIS Parl. Fl. Ital. 1: 368. 1848. *Poa festucaeformis* Host, Gram. Austr. 3: 12. 1805.

4. **P. angustata** Nash. Culms erect, tufted, about 1 foot high; blades involute, erect, smooth; panicles narrow, 2 to 3 inches long, the branches about 1 inch long, appressed; spikelets about 3 lines long; glumes 3-nerved, the first 1 line, the second $1\frac{1}{2}$ lines long; lemmas $1\frac{1}{2}$ lines long, sparingly pubescent at base, especially on the lower part of the rather prominent marginal nerves.

Saline soil, Mendocino Co. (Ft. Bragg, *Davy & Blasdale* 6126) to Alaska; also on the Atlantic Coast from Connecticut northward.

Refs.—PUCCINELLIA ANGUSTATA Nash, Bull. Torr. Club 22: 512. 1895. *Poa angustata* R. Br. App. Parry's Voy. 287. 1824.

5. **P. simplex** Scribn. Apparently annual; culms 3 to 8 inches high; blades narrow, soft, flat, scattered; panicle narrow, about $\frac{1}{2}$ the length of the entire plant, the branches few, short, and appressed; spikelets 3 to 4 lines long, appressed; glumes strongly 3-nerved, $\frac{1}{2}$ and 1 line long; lemmas $1\frac{3}{4}$ lines long, tapering from below the middle to the acute apex, pubescent on lower half.

Alkaline soil; only known from California. Woodland; Livermore Pass, *Davy;* Tulare Co., *Congdon.*

Refs.—PUCCINELLIA SIMPLEX Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 16: 1. f. 1. 1899, type from Woodland, *Blankinship* in 1893.

61. FESTUCA L.

Spikelets 2 to several-flowered in narrow or open panicles. Glumes narrow, acute, the first 1-nerved, the second 3-nerved. Lemmas firm, rounded on the back, at least below, acute or awned from tip, rarely obtuse or awned from a cleft apex, faintly 3 to 5-nerved. Annuals or perennials, usually tufted. Species about 100, throughout the temperate and cooler parts of the world. (An ancient Latin name for a kind of grass.)

Plants annual.
Spikelets densely 5 to 13-flowered; lemmas without scarious margin.......1. *F. octoflora.*
Spikelets loosely 1 to 5-flowered; lemmas with narrow scarious margin.
Branches of the short panicle normally divergent, a pulvillus at the base of at least 1 of them.
Florets mostly 3 to 5 in each spikelet; only the principal panicle branches divergent.
Lemmas glabrous.
Glumes glabrous ....2. *F. pacifica.*
Glumes hirsute ....3. *F. confusa.*
Lemmas hirsute.
Glumes glabrous ....4. *F. eriolepis.*
Glumes hirsute ....5. *F. grayi.*

Florets mostly 1 to 3 in each spikelet; all the spikelets divergent.
Lemmas glabrous ....6. *F. reflexa.*
Lemmas pubescent.
Glumes glabrous ....7. *F. microstachys.*
Glumes pubescent ....8. *F. eastwoodae.*
Branches of the narrow panicle erect or appressed.
Lower glume ⅔ to ¾ as long as the upper........................11. *F. bromoides.*
Lower glume not more than ½ as long as upper.
Lemma ciliate ....9. *F. megalura.*
Lemma not ciliate ....10. *F. myuros.*
Plants perennial.
Rhizomes present; blades flat; lemma acuminate, unawned..............25. *F. confinis.*
Rhizomes wanting (base of culm decumbent in F. rubra).
Blades flat, rather soft and lax.
Lemmas awnless, indurated, not keeled..........................21. *F. elatior.*
Lemmas awned, membranaceous, more or less keeled.
Floret long-stipitate ....22. *F. subuliflora.*
Floret sessile.
Awn terminal ....24. *F. subulata.*
Awn from a cleft apex..23. *F. elmeri.*
Blades usually folded or involute, narrow or capillary.
Collar and auricles tomentose or bristly.
Plant stout, usually over 3 feet tall; lower sheaths glabrous....19. *F. californica.*
Plant more slender, about 1½ feet tall; sheaths puberulent.........20. *F. parishii.*
Collar and auricles not conspicuously tomentose or bristly.
Lemmas acute, unawned or only awn-pointed......................18. *F. viridula.*
Lemmas awned.
Tufts loose, the bases of the culms decumbent; blades usually smooth to the touch.. 12. *F. rubra.*
Tufts compact; culms erect.
Panicle open, the branches long and spreading; awn longer than body of lemma.. 14. *F. occidentalis.*
Panicle narrow, the branches ascending.
Blades scabrous, usually elongated......................15. *F. idahoensis.*
Blades smooth.
Plants about 4 feet tall................................13. *F. howellii.*
Plants low, usually less than 6 inches high.
Blades hard, involute, shining, not angled..............17. *F. supina.*
Blades soft, angled in drying, the tissue soft between the angles........ 16. *F. brachyphylla.*

Subgenus Vulpia Hack. Annuals; stamens usually only 1, sometimes 3; florets usually remaining unopened, consequently self-pollinated; joints of the rachilla usually clavate.

1. **F. octoflora** Walt. Culms slender, erect, usually 6 to 12 inches high; blades narrow, involute; panicle narrow, the branches short, appressed; spikelets 3 to 4 lines long, densely 5 to 13-flowered; glumes subulate-lanceolate, the first 1-nerved, 1½ lines long, the upper 3-nerved, 2 lines long; lemmas firm, convex, lanceolate, glabrous or scabrous, the margins not scarious, 2 to 2½ lines long, attenuate into a scabrous awn 1 to 2 lines long.

Open ground, in the southwestern portion of the state, also in Santa Clara Co. (*Heller* 7373); throughout the U. S.

Var. **hirtella** Piper. Differs in being usually in low spreading tufts; foliage usually pubescent; lemmas hirtellous or pubescent. More frequent than the species, growing in more arid ground; San Luis Obispo Co. to the Mohave Desert and southward; also on Mt. Tamalpais (*Chase* 5678) and in northern Inyo Co. (*Heller* 8196); southeast to Arizona and northern Mexico.

Refs.—Festuca octoflora Walt. Fl. Carol. 81. 1788; Abrams, Fl. Los Ang. 52. 1904. *F. tenella* Willd. Sp. Pl. 1: 419. 1797; Thurb. in Wats. Bot. Cal. 2: 317. 1880. Var. hirtella Piper, Contr. Nat. Herb. 10: 12. 1906.

2. **F. pacifica** Piper. Culms slender, erect, 1 to 2 feet high; blades soft, glabrous, loosely involute; panicle 2 to 5 inches long, the lower branches solitary, divaricate; spikelets 3 to 6-flowered; glumes glabrous, the first subulate-lanceolate, 1-nerved, 2 lines long, the second lanceolate-acuminate, 3-nerved, 2½ lines long; lemmas lanceolate, scabrous, except in the lowermost floret (this smooth), 3 to 3½ lines long, attenuate into a scabrous awn 5 to 7 lines long.

Open ground, mountain slopes and open woods, throughout the state, except the Great Valley and the Mohave Desert; extends from British Columbia to Arizona and Lower California.

Ref.—Festuca pacifica Piper, Contr. Nat. Herb. 10: 12. 1906.

3. **F. confusa** Piper. Differs from F. pacifica in having hirsute glumes; plants small and slender; sheaths and blades pubescent; spikelets 2 or 3-flowered.

Dry hillsides, middle California to Washington. Mt. Diablo, *Brewer* 1142, *Hall* 1737; Northfork, *Griffiths* 4608c; Santa Lucia Mts., *Eastwood*.

Ref.—Festuca confusa Piper, Contr. Nat. Herb. 10: 13. pl. 1. 1906.

4. **F. eriolepis** Desv. Culms 4 to 15 inches high; sheaths glabrous or pubescent: blades soft, loosely involute, usually glabrous; panicle 1 to 3 inches long, the solitary rays at length divaricate; glumes lanceolate, glabrous, the first 3 to 3½ lines long, the second a little longer; lemmas lanceolate, densely villous, 3 to 3½ lines long, attenuate into a scabrous awn nearly as long.

Sandy ground, northern California and Nevada; also Chile.

Locs.—Modoc Co., *Griffiths & Hunter* 406; Castella, *Piper* 6346; Ukiah, *Bolander* 6118; Truckee, *Sonne* 7.

Refs.—Festuca eriolepis Desv. in Gay, Fl. Chil. 6: 428. 1853. *F. arida* Elmer, Bot. Gaz. 36: 52. 1903.

5. **F. grayi** Piper. Habit of F. pacifica, but somewhat stouter; sheaths and sometimes blades pubescent; glumes and lemmas pubescent or puberulent throughout; spikelets 3 to 5-flowered.

Open ground and rocky slopes; Yolo Co. (*Blankinship* 20) and Amador Co. (*Hansen* 632) to Ventura Co. (*Hubby* 40) and Imperial Co. (*Schoenfeldt* 3634 in part); north to Oregon and east to Arizona.

Refs.—Festuca grayi Piper, Contr. Nat. Herb. 10: 14. 1906. *F. microstachys* Nutt. var. *grayi* Abrams, Fl. Los Ang. 52. 1904. Var. *ciliata* Gray; Davy in Jepson, Fl. W. Mid. Cal. 69. 1901.

6. **F. reflexa** Buckl. Culms 8 inches to 1½ feet high; sheaths smooth or pubescent; blades narrowly linear, flat or loosely involute; panicle 2 to 5 inches long, the solitary rays and the spikelets all at length divaricate; spikelets 1 to 3-flowered, 2½ to 3½ lines long; glumes glabrous, the first 1 to 2 lines long, the second 2 to 2½ lines long; lemmas glabrous or somewhat scabrous, 2½ to 3 lines long, attenuate into a scabrous awn, usually 2½ to 4 lines long.

Mesas, rocky slopes and wooded hills; Mendocino Co. (*Davy* 5049) to San Diego (*Orcutt* 1073), also in Madera Co. (*Griffiths* 4423), Kern Co. (*Davy* 1898) and Panamint Mts. (*Coville & Funston* 775); north to Vancouver Island and east to Utah.

Refs.—Festuca reflexa Buckl. Proc. Acad. Phila. 1862: 98. 1863, type collected by Nuttall in "Upper California." *F. microstachys* Nutt. var. *pauciflora* Scribn.; Beal, Grasses N. Am. 2: 586. 1896; Davy in Jepson, Fl. W. Mid. Cal. 69. 1901.

7. **F. microstachys** Nutt. Habit of F. reflexa; differing in having pubescent lemmas.—Less frequent than that species.

Banks, hillsides and open ground, California to Oregon.

Locs. Napa City, *Jepson* in 1893; Yosemite Nat. Park, *Chase* 5702; Carmel Mission, *Heller* 6583; Salt Creek, Tulare Co., *Eastwood* in 1894 in part; Pasadena, *Allen* in 1885.

Refs.—FESTUCA MICROSTACHYS Nutt. Jour. Acad. Phila. II. 1: 187. 1848, type from "Pueblo de los Angeles, Upper California"; Thurb. in Wats. Bot. Cal. 2: 317. 1880; Davy in Jepson, Fl. W. Mid. Cal. 69. 1901; Abrams, Fl. Los Ang. 51. 1904.

8. **F. eastwoodae** Piper. Differs from F. reflexa in having pubescent glumes and lemmas. Rare.

Open pine forests: Santa Lucia Mts.; Salt Creek, Tulare Co., *Eastwood* in 1894 in part; Volcano, collector unknown.

Ref.—FESTUCA EASTWOODAE Piper, Contr. Nat. Herb. 10: 16. 1906, type from Santa Lucia Mts., *Eastwood* in 1897.

9. **F. megalura** Nutt. Culms 8 inches to 2 feet high; sheaths and blades smooth; panicle narrow, 3 to 8 inches long, the branches appressed; spikelets 4 or 5-flowered; glumes glabrous, very unequal, the first about 1 line long or less, the second 2 to 2½ lines long; lemmas linear-lanceolate, scabrous above, ciliate on the upper half, attenuate into an awn about twice its length.—The cilia on the lemmas, by which this species is distinguished from F. myuros, are sometimes hidden by the incurved edges of the lemma at maturity.

Cultivated or open ground, sandy soil, and waste places, mostly in the Coast Ranges; extends from British Columbia to Idaho and Lower California.

Refs.—FESTUCA MEGALURA Nutt. Jour. Acad. Phila. II. 1: 188. 1848, type from Santa Barbara, *Gambel*. *F. myuros* L. var. *ciliata* [Coss. misapplied by] Davy in Jepson, Fl. W. Mid. Cal. 70. 1901; Abrams, Fl. Los Ang. 52. 1904. This is included under *F. myuros* L. by Thurber (Wats. Bot. Cal. 2: 316. 1880).

10. **F. myuros** L. Similar to F. megalura but lemmas not ciliate.

Open ground, introduced from Europe into the Eastern States; rare on the Pacific Coast. San Francisco, Wilkes Exped.; San Diego, *Brandegee* 86 in part; Santa Catalina Island, *Brandegee* 53.

Refs.—FESTUCA MYUROS L. Sp. Pl. 74. 1753; Thurb. in Wats. Bot. Cal. 2: 316. 1880; Davy in Jepson, Fl. W. Mid. Cal. 69. 1901; Abrams, Fl. Los Ang. 32. 1904.

11. **F. bromoides** L. Similar to F. megalura; culms 4 to 12 inches high; panicle dense, 2 to 4 inches long; glumes unequal, the first 2 lines long, the second 3 to 3½ lines long; lemma 3½ to 4 lines long, the awn 5 to 6 lines long.

Dry hills and meadows, Santa Barbara and San Bernardino cos. to Vancouver Island; introduced from Europe.

Refs.—FESTUCA BROMOIDES L. Sp. Pl. 75. 1753. *F. sciuroides* Roth, Cat. Bot. 2: 11. 1800. *F. myuros* L. var. *sciuroides* Coss. in Coss. & Dur. Expl. Algér. 2: 174. 1867.

Subgenus EUFESTUCA Griseb. Perennials, often densely tufted, sometimes decumbent at base but not producing scaly rhizomes.

12. **F. rubra** L. Culms erect from a decumbent or somewhat creeping base, smooth, 1½ to 3 feet high; sheaths smooth, the lowermost usually purple; blades smooth, soft, usually folded or involute; panicle 2 to 8 inches long, usually contracted and narrow, the rays mostly erect; spikelets 4 to 6-flowered, pale green or glaucous, often purple-tinged; lemmas 2½ to 3½ lines long, smooth, or scabrous toward apex, bearing a scabrous awn usually about ½ as long.

Meadows and hills, in the Sierra Nevada and San Bernardino mountains, and in the Coast Ranges as far south as Monterey. Northern part of the northern hemisphere, in America extending south to Virginia, Colorado, and southern California.

Refs.—FESTUCA RUBRA L. Sp. Pl. 74. 1753; Davy in Jepson, Fl. W. Mid. Cal. 68. 1901. *F. ovina* L. var. *rubra* Gray, Man. ed. 5. 633. 1867; Thurb. in Wats. Bot. Cal. 2: 317. 1880. *F. rubra* var. *multiflora* Aschers. & Graebn. Syn. Mitteleur. Fl. 2: 499. 1900. Var. *densiuscula* Hack.; Piper, Contr. Nat. Herb. 10: 22. 1906 (as subsp.). Var. *pruinosa* Hack. in Rep. Bot. Exchange Club Brit. Isles 119. 1884.

Piper has recognized three subspecies of F. rubra in California (Contr. Nat. Herb. 10: 22. 1906): *F. rubra multiflora* Aschers. & Graebn. Lake Tahoe, *Hitchcock* in 1901; Bear Valley, *Lemmon* 5434. A specimen collected by Anderson at Santa Cruz appears to belong to this form. *F. rubra pruinosa* Hack. Ft. Bragg, *Davy & Blasdale* 6117; Pt. Reyes, *Davy* 6811. *F. rubra densiuscula* Hack. Crescent City, *Davy & Blasdale* 5931, 5932. These specimens appear to belong to the same form as the two preceding.—These forms appear to be scarcely worthy of varietal rank. The first is distinguished chiefly by being tall and stout and by having flat blades. The second and third by the denser panicle and glaucous spikelets, the second having green leaves and the third glaucous leaves.

13. **F. howellii** Hack. Resembling F. rubra but tall and stout, about 4 feet high; culms numerous, erect at base, in a close tuft; blades a foot or more long, folded, smooth; spikelets larger, the lemmas about 3½ lines long, awned.

Sherwood Valley, *Davy & Blasdale* 5231; rocky woods, Sherwood, *Hitchcock* 2706, 2716; Mt. Hood, Sonoma Co., *Heller* 5628. The specimens mentioned may be forms of the variable F. rubra, but they agree in the characters given. *Heller* no. 5628 is a good match for the type from Deer Creek Mt., Oregon (*Howell* 248), the only other specimen known.

Ref.—FESTUCA HOWELLII Hack.; Beal, Grasses N. Am. 2: 591. 1896.

14. **F. occidentalis** Hook. Culms densely tufted, slender, erect, shining, 1½ to 2½ feet high; sheaths smooth; blades numerous, mostly basal, filiform-involute, bright green, soft, 2 to 8 inches long; panicle loose, subsecund, 3 to 8 inches long, often drooping above, the rays solitary or the lowest in pairs; spikelets loosely 3 to 5-flowered, 3 to 5 lines long, mostly on slender pedicels, pale green; lemmas rather thin, 2½ to 3 lines long, scaberulous toward the apex, attenuate into a slender awn about as long.

Dry rocky wooded slopes and banks; Sequoia Nat. Park (*Davidson* 2114) and San Mateo Co. (*Baker* 1920); north to British Columbia and east to Wyoming and northern Michigan.

Ref.—FESTUCA OCCIDENTALIS Hook. Fl. Bor. Am. 2: 249. 1840.

15. **F. idahoensis** Elmer. BLUE BUNCHGRASS. Culms densely tufted, smooth or somewhat scabrous above, 1 to 3 feet high; blades numerous, mostly basal, rather stiff and firm, more or less flexuous, scabrous, 6 to 12 inches long, sometimes shorter; panicle narrow, 4 to 8 inches long, the branches appressed or ascending, very scabrous; spikelets about as in F. rubra, the lemmas firmer, the awn 1 to 2 lines long.

Open woods and rocky slopes; middle California to British Columbia, east to Alberta and Colorado.

Locs.—Warner Mts., *Griffiths & Hunter* 469, 472; Alturas, *Applegate* 898; Castella, *Piper* 6329; Trinity Co., *Blankinship* 11; Hupa, *Chandler* 1366; Mendocino Co., *Davy & Blasdale* 5314; Plumas Co., *Lemmon* 4653; Mt. Sanhedrin, *Heller* 5951; Hood's Peak, Sonoma Co., *Heller* 5629; Vaca Mts., *Jepson* in 1897; Congress Springs, *Hitchcock* 2655.

Refs.—FESTUCA IDAHOENSIS Elmer, Bot. Gaz. 36: 53. 1903. *F. ingrata* Rydb. Bull. Torr. Club 32: 608. 1905. *F. ovina* L. var. *ingrata* Hack.; Beal, Grasses N. Am. 2: 598. 1896.

16. **F. brachyphylla** Schult. Culms erect, tufted, low, 4 to 6 inches high; blades about ½ as long as the culms, filiform, soft, angled in drying, the tissue soft between the angles; panicle short and narrow, 1 to 2 inches long, few

flowered; glumes and lemmas broad, rather soft; awn of the lemma about ½ line long.

Mt. Dana, above timber-line (the only known locality in California), *Bolander* (no. 6100) and *Brewer* (no. 5066 in part). Arctic America, south in the Rocky Mts. to Arizona and Blue Mts. of Oregon.

Refs. FESTUCA BRACHYPHYLLA Schult. Mant. 3: 646. 1827. *F. brevifolia* R. Br. App. Parry's Voy. Suppl. 289. 1824, not Muhl. 1817. *F. ovina* L. var. *brevifolia* Wats. U. S. Expl. 40th Par. 5: 389. 1871; Thurb. in Wats. Bot. Cal. 2: 317. 1880. Rydberg refers the above specimens to F. minutiflora Rydb. Bull. Torr. Club 32: 608. 1905 (type from Colorado).

17. **F. supina** Schur. Culms erect, densely tufted, 3 to 6 inches high; blades numerous, usually less than ½ the length of the culm, involute, smooth, firm and hard, scarcely angled in drying; inflorescence about as in F. brachyphylla, the lemmas firmer, narrower, involute and more scabrous, the florets looser and more numerous and the awn longer.

In the high Sierra Nevada from Mono Lake south, and in the San Bernardino Mts., mostly above 11,000 feet altitude; extends from Greenland to the White Mts. of New Hampshire and from British Columbia and Alberta south in the mountains to Arizona and California.

Locs.—White Mts., *Shockley* 616; Mt. Dana, *Hall & Babcock* 3608; Mt. Lyell, *Hitchcock* 3293; Kings River, *Lemmon* in 1902; Denels Peak, *Hall & Babcock* 5514; Sawtooth Peak, *Hall & Babcock* 5676; Farewell Gap, *Purpus* 5117; Mt. Whitney, *Hitchcock* 3444; Grayback Mt., *Reed* 2740; San Gorgonio Mt., *Hall* 7639.

Refs.—FESTUCA SUPINA Schur. Enum. Pl. Transs. 784. 1866. *F. ovina* L. var. *supina* Hack. Bot. Centr. 8: 405. 1881.

18. **F. viridula** Vasey. Culms rather loosely tufted, erect, smooth, 2 to 3 feet high; sheaths smooth; blades erect, 1 line wide or less, soft, scaberulous above, often more or less involute; panicle loose and open, 4 to 6 inches long, the branches ascending; spikelets 3 to 6-flowered; glumes membranaceous, smooth, about 1½ lines long; lemmas firm, membranaceous, keeled toward the apex, acute or somewhat mucronate, 3 to 3½ lines long.

Subalpine meadows, Washington and Idaho to the high mountains of central California.

Locs.—Geysers, Sonoma Co., *Bolander* 3945; Webber Lake, *Leiberg* 5262; Donner Lake, *Davy* 3222; Sierra Valley, *Brewer* 1976; Mt. Tallac, *Hitchcock* 3155.

Refs.—FESTUCA VIRIDULA Vasey, U. S. Dept. Agr. Div. Bot. Bull. 13^2: pl. 93. 1893, type collected in California by *Bolander*. *F. gracillima* [Hook. misapplied by] Thurb. in Wats. Bot. Cal. 2: 318. 1880.

19. **F. californica** Vasey. Culms tufted, stout, coarse, usually 3 to 5 feet high, scabrous, sheaths somewhat scabrous, the lower persistent, the collar and auricles pilose; blades flat or becoming involute when dry, hard and firm, scabrous, the lower much elongated; panicle large, usually loose and open, the branches few, long and slender, naked below, bearing a few large spikelets toward the ends; spikelets compressed, about 5-flowered; glumes oblong-lanceolate, firm, smooth, except the scabrous keel, 3 to 4 lines long; lemmas 4 to 5 lines long, lanceolate, convex, firm, scabrous, acuminate or short-awned.

Meadows, shady banks and borders of woods, in the Coast Ranges from Monterey Co. (*Davy* 7344) to Humboldt Co. (*Davy* 6599) and Mt. Shasta (*Heller* 7944); north to Oregon.

Refs.—FESTUCA CALIFORNICA Vasey, Contr. Nat. Herb. 1: 277. 1893, type from San Francisco, *Bolander* 1505; Davy in Jepson, Fl. W. Mid. Cal. 69. 1901. *F. scabrella* [Torr. misapplied by] Thurb. in Wats. Bot. Cal. 2: 318. 1880. *F. kalmii* Gray var. *aristulata* Torr. U. S. Rep. Expl. Miss. Pacif. 4: 157. 1856, type from Mark West Creek, *Bigelow* in 1854. *F. aristulata* Shear; Piper, Contr. Nat. Herb. 10: 32. 1906. *Bromus depauperatus* [Presl, misapplied by] Thurb. in Wats. Bot. Cal. 2: 320. 1880. The specimen in the Gray Herbarium *(Bolander*

3945), upon which Thurber based his description, is *Festuca californica*. *Bromus depauperatus* Presl is said to have been collected by Haenke at Nootka Sound on Vancouver Island. The type specimen, in the Bohemian National Museum at Prague, is a species of Festuca closely allied to *F. elmeri* Scribn. & Merr. but appears to be different from any known species from the Northwestern States. There is nothing on the label accompanying the type specimen to indicate its origin and the published locality may be an error. In the type specimen the lemmas are firm, terete, indistinctly nerved, scabrous, long acuminate, long-awned from between setaceous teeth. Presl's description is accurate.

20. **F. parishii** Hitchc. n. comb. Resembles F. californica but culms lower, about 1½ to 2 feet high; sheaths puberulent; blades 6 to 10 inches long, closely involute, smooth below or nearly so; panicle 4 to 5 inches long; awn of lemma 1½ to 2 lines long.

Only known from the San Bernardino Mts. (*Parish Bros.* 857, *Parish* 2490, 5036).

Refs.—FESTUCA PARISHII Hitchc. *F. aristulata* Shear subsp. *parishii* Piper, Contr. Nat. Herb. 10: 33. 1906, type *Parish* 5036.

21. **F. elatior** L. MEADOW FESCUE. Culms smooth, 2½ to 4 feet high; sheaths smooth; blades flat, 2 to 4 lines wide, scabrous above; panicle erect, or nodding at summit, 4 to 8 inches long, contracted after flowering, much-branched or nearly simple, the branches spikelet-bearing nearly to base; spikelets usually 6 to 8-flowered, 4 to 6 lines long; glumes 1½ and 2 lines long, lanceolate; lemmas oblong-lanceolate, coriaceous, 2½ to 3½ lines long, the scarious apex acutish.

Meadows and roadsides: Mt. Shasta, *Lemmon* 5458; Yreka, *Butler* 1636; Jess Valley, Modoc Co., *Griffiths* & *Hunter* 409. A native of Europe, cultivated in the U. S. under the name of Meadow Fescue, and escaped into fields and waste places throughout the cooler portion of America.

Refs.—FESTUCA ELATIOR L. Sp. Pl. 75. 1753. *F. pratensis* Huds. Fl. Angl. 37. 1762.

22. **F. subuliflora** Scribn. Culms rather slender, glabrous, 2 to 3 feet high; sheaths sparsely hispidulous; blades flat, rather soft, hirsutulous above, 1½ to 3 lines wide; panicle loose, open, somewhat drooping, 4 to 8 inches long, the branches slender, mostly solitary, naked below the middle; spikelets loosely 3 to 4-flowered; glumes subulate, glabrous, 1-nerved, 1½ and 2 lines long; lemmas lanceolate, scabrous toward the apex, keeled above, 3 to 4 lines long, tipped with a more or less flexuous awn 5 to 7 lines long, abruptly contracted at base into a hispidulous tubular structure including the rachilla, the latter apparently disarticulating half way between the florets.

In the Coast Ranges of northern California, north to Vancouver Island.

Locs.—Crescent City, *Davy & Blasdale*; Humboldt Bay, *Chandler* 1184; Kneeland, *Blankinship* 7; Hubbard Sta., *Davy & Blasdale* 5407.

Refs.—FESTUCA SUBULIFLORA Scribn. in Macoun, Cat. Can. Pl. 5: 396. 1890. *F. denticulata* Beal, Grasses N. Am. 2: 589. 1896; Davy in Jepson, Fl. W. Mid. Cal. 69. 1901.

23. **F. elmeri** Scribn. & Merr. Culms slender, 1½ to 3 feet high, glabrous; sheaths nearly smooth; blades flat, scabrous or pubescent above, 1 to 2 lines wide; panicle 4 to 8 inches long, loose, open, the branches mostly in pairs, smooth or nearly so, naked below; spikelets 3 or 4-flowered; glumes lanceolate, glabrous, 1 and 1½ to 2 lines long; lemmas lanceolate, membranaceous, minutely hispidulous, 3 lines long, cleft at the apex and bearing between the short teeth a scabrous awn 1 to 4 lines long.

Wooded hillsides, California to Oregon, mostly in the Coast Ranges.

Locs.—Marysville Buttes, *Heller* 5562; Ukiah, *Davy & Blasdale* 5029; Lake Co., *Davy* 6648; San Francisco, *Bolander* 1507; Stanford University, *Abrams* 1646, *Elmer* 2101; Los

Gatos, *Heller* 7471; Santa Cruz, *Anderson;* Tassajara Hot Springs, *Elmer* 3322; Templeton, *Davy* 7584; San Luis Obispo, *Lemmon* 4654.

Var. **luxurians** Piper. Panicle rather close; spikelets 5 or 6-flowered.—Moist groves, San Francisco Bay region: Oakland, *Bolander* 6073; Stanford University, *Elmer* 2103, 2133.

Refs.—FESTUCA ELMERI Scribn. & Merr. Bull. Torr. Club 29: 468. 1902, type from Stanford University, *Elmer* 2101. Var. LUXURIANS Piper, Contr. Nat. Herb. 10: 38. 1906, based on the next. *F. jonesii* Vasey var. *conferta* Hack.; Beal, Grasses N. Am. 2: 593. 1896, type from San Jose Normal School, collector unknown.

24. **F. subulata** Trin. Culms scaberulous, 1½ to 4 feet high; sheaths nearly smooth; blades flat, thin, 1½ to 5 lines wide, auriculate at base, usually scabrous on both surfaces, lax and spreading; panicle very loose, somewhat drooping, 6 to 15 inches long, the branches mostly in pairs, naked below; spikelets 3 to 5-flowered; glumes subulate; lemmas membranaceous, narrowly lanceolate, 3-nerved, somewhat keeled, attenuate into a scabrous awn 3 to 10 lines long.

Moist rocky woods and shady banks, Alaska to Montana and Wyoming, south to California. Moulton, Warner Mts., *Griffiths & Hunter* 473; Sequoia Nat. Park, Redwood Meadows, *Hitchcock* 3380.

Refs.—FESTUCA SUBULATA Trin. in Bong. Mém. Acad. St. Pétersb. VI. Math. Phys. Nat. 2: 173. 1832. *F. pauciflora* [Thunb. misapplied by] Thurb. in Wats. Bot. Cal. 2: 318. 1880.

Subgenus HESPEROCHLOA Piper. Perennials, densely tufted but producing occasional stout rhizomes or stolons.

25. **F. confinis** Vasey. Culms stout, erect, glabrous, 1½ to 3 feet high; sheaths smooth, striate; blades firm, flat or loosely involute, coarsely striate, 1½ to 3 lines wide; panicle narrow, erect, 3 to 8 inches long, the branches short and appressed, floriferous nearly to base; glumes broadly lanceolate, subscarious, nearly smooth, the first 1½ to 2 lines long, the second a half longer; lemmas ovate, acuminate, convex, faintly nerved, scabrous all over the back, 2½ to 4 lines long.

Dry meadows and hills; San Bernardino Mts., north to Oregon and east to Montana and Colorado.

Locs.—Truckee, *Sonne* 11; San Gorgonio Mt., *Abrams & McGregor* 778, *Hall* 7621; Coon Creek, San Bernardino Mts., *Hall* 7585.

Ref.—FESTUCA CONFINIS Vasey, Bull. Torr. Club 11: 126. 1884.

62. BROMUS L.

Spikelets few to many-flowered, terete or flattened, in narrow or open panicles. Glumes unequal, acute, 1 to 5-nerved. Lemmas convex or sharply keeled, 5 to 9-nerved, usually 2-toothed at apex and awned from between the teeth, sometimes awnless, the awn straight or divergent, sometimes twisted. Annuals or perennials with usually flat blades, and rather large spikelets.—Species about 100, mostly in the north temperate zone. (An ancient Greek name for the oat.)

- Plants annual.
  - Panicle contracted, dense
    - Awn 8 to 11 lines long.
      - Culm pubescent below panicle..............................11. *B. rubens.*
      - Culm smooth..............................9. *B. madritensis.*
    - Awn 3 to 4 lines long.
      - Awn divaricate; second glume 3-nerved..............................8. *B. scoparius.*
      - Awn straight; second glume 5 to 7-nerved..............................4. *B. hordeaceus.*

Panicle open, the branches spreading.
Awn short or wanting.
Lemmas broad, obtuse ....7. *B. brizaeformis.*
Lemmas acuminate ....18. *B. unioloides.*
Awn well-developed (cf. B. carinatus).
Awn twisted and bent..1. *B. trinii.*
Awn not twisted and bent.
Sheaths smooth; florets turgid; awn 1½ to 2½ lines long.........2. *B. secalinus.*
Sheaths pubescent; awn usually long.
Awn 1½ to 2 inches long..10. *B. villosus.*
Awn not more than 8 lines long.
First glume 1-nerved ....12. *B. tectorum.*
First glume 3-nerved.
Lemmas pubescent ....6. *B. arenarius.*
Lemmas glabrous.
Awns all alike ....3. *B. commutatus.*
Awns of the lower florets shorter..5. *B. japonicus.*
Plants perennial.
Spikelets subterete, not strongly flattened.
Panicle narrow, the branches erect..17. *B. suksdorfii.*
Panicle open, the branches spreading.
Branches of panicle stiffly divaricate; blades short..............13. *B. orcuttianus.*
Branches drooping; blades elongated.
Lemmas pubescent throughout ....14. *B. grandis.*
Lemmas pubescent at margins or base only, or nearly glabrous.
Lemmas densely pubescent at base and margins; lower glume 3-nerved.......... 16. *B. laevipes.*
Lemmas sparsely pubescent on back, ciliate on margins or nearly glabrous; lower glume 1-nerved ....15. *B. vulgaris.*
Spikelets strongly flattened.
Blades canescent and densely pilose, narrow or involute............19. *B. subvelutinus.*
Blades not canescent, glabrous or somewhat pilose, broader, flat.
Panicle narrow, the branches short and erect....................21. *B. maritimus.*
Panicle open, the branches spreading or drooping.
Awn less than 3½ lines long; blades rather broad.............20. *B. marginatus.*
Awn more than 3½ lines long; blades usually narrow............22. *B. carinatus.*

DIVISION I. Introduced annuals (cf. B. unioloides in Div. 3).

1. **B. trinii** Desv. Culms erect, 1 to 2 feet high; sheaths pilose or nearly smooth; blades usually pilose; panicle narrow, 4 to 8 inches long, rather dense; spikelets narrow, 5 to 7-flowered, 7 to 10 lines long; glumes lanceolate, acuminate, smooth, the first mostly 1-nerved, 4 to 5 lines long, the second broader, mostly 3-nerved, 6 to 8 lines long; lemmas coarsely and sparsely pubescent, 5-nerved, 6 to 7 lines long, acuminate, with 2 narrow teeth 1 line long; awn 7 to 10 lines long, twisted below, bent below the middle and strongly divaricate when old.

Dry plains and rocky or wooded slopes: Klamath Bluffs, Siskiyou Co. (*Butler* 1185); San Francisco and Contra Costa cos. south, especially in desert regions; east to Colorado and south to Mexico; also Chile.

Var. **excelsus** Shear. Lemma 7-nerved, the awn scarcely twisted or bent.—A little known form which may prove to be a distinct species. The type is from the Panamint Mts. (*Coville & Funston* 522). Another specimen, *Wilder* 1062, from Glenavon, is doubtfully referred to this variety.

REFS.—BROMUS TRINII Desv. in Gay, Fl. Chil. 6: 441. 1853; Abrams, Fl. Los Ang. 53. 1904. Var. *pallidiflorus* Desv. in Gay, Fl. Chil. 6: 441. 1853; Abrams, Fl. Los Ang. 54. 1904. *Trisetum barbatum* Steud. Syn. Pl. Glum. 1: 229. 1854; Davy in Jepson, Fl. W. Mid. Cal. 52. 1901. Var. EXCELSUS Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 25. 1900.

2. **B. secalinus** L. CHEAT. CHESS. Culms erect, 1 to 2 feet high; sheaths smooth; panicle pyramidal, drooping, 3 to 5 inches long, open, the lower branches 3 to 5, unequal; spikelets ovoid-lanceolate, becoming somewhat laterally compressed and turgid in fruit, 5 to 9 lines long, 3 to 4 lines wide; glumes smooth, obtuse, the first 3 to 5-nerved, 2 to 3 lines long, the second 7-nerved, 3 to 3½ lines long; lemmas 7-nerved, 3 to 4 lines long, elliptic, obtuse, smooth or scabrous, the margin strongly involute in fruit, shortly bidentate at apex, the undulate awn usually 1½ to 2½ lines long; palea about as long as lemma.—In fruit the turgid florets are somewhat distant so that, viewing the spikelet sidewise, the light passes through the small openings at the base of each floret.

A weed in grain fields and waste places, more or less throughout the U. S., introduced from Europe.

Locs.—Yreka, *Butler* 826; Modoc Co., *Hall & Babcock* 4246; Dixie Valley, *Davy;* Hupa Valley, *Davy* 5688; Chat, *Davy;* Yosemite Nat. Park, *Hall & Babcock* 3398; Los Angeles.

Refs.—BROMUS SECALINUS L. Sp. Pl. 76. 1753; Thurb. in Wats. Bot. Cal. 2: 319. 1880; Abrams, Fl. Los Ang. 53. 1904.

3. **B. commutatus** Schrad. Resembling B. secalinus; sheaths pilose with short retrorse hairs; lemmas with an obtuse angle on the margin just above the middle, the margin not as strongly inrolled in fruit as in B. secalinus, the awn straight and rather longer.—In fruit the less turgid florets are imbricated, leaving no spaces at the base of the florets as in B. secalinus.

A weed in fields and waste places, Washington to California and Montana and more sparingly in the Eastern States. Introduced from Europe.

Locs.—Castle Crag, *Hitchcock* 3067; Sherwood Valley, *Davy & Blasdale* 5152; Ft. Bragg, *Davy & Blasdale* 6112; Pt. Reyes, *Davy* 6762; Santa Barbara, *Hitchcock* 2579; San Bernardino, *Parish* 2175.

Refs.—BROMUS COMMUTATUS Schrad. Fl. Germ. 353. 1806. *B. racemosus* [L. misapplied by] Thurb. in Wats. Bot. Cal. 2: 320. 1880.

4. **B. hordeaceus** L. Culms 8 inches to 2½ feet high; sheaths retrorsely softly pilose-pubescent; blades usually pubescent; panicle contracted, erect, 2 to 4 inches long, or, in depauperate plants, reduced to a few spikelets; glumes broad, obtuse, coarsely pilose or scabrous-pubescent, the first 3 to 5-nerved, 2 to 3 lines long, the second 5 to 7-nerved, 3½ to 4 lines long; lemmas broad, obtuse, 7-nerved, coarsely pilose or scabrous-pubescent, rather deeply bidentate, 4 to 4½ lines long, the margin and apex hyaline; awn rather stout, 3 to 4½ lines long; palea about ¾ as long as lemma .

A weed in waste places and cultivated soil, abundant on the Pacific Coast, occasional in the Eastern States, introduced from Europe.

Var. **leptostachys** Beck. Differs in having glabrous, or only scabrous spikelets.—Waste places, Siskiyou Co. (*Butler* 817) to Yosemite Valley (*Bioletti* 16) and Stanford University (*Rutter* 2).

Refs.—BROMUS HORDEACEUS L. Sp. Pl. 77. 1753; Davy in Jepson, Fl. W. Mid. Cal. 71. 1901; Abrams, Fl. Los Ang. 53. 1904. Var. LEPTOSTACHYS Beck, Fl. Niederösterr. 109. 1890. Var. *glabrescens* Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 20. 1900; Davy in Jepson, Fl. W. Mid. Cal. 72. 1901.

5. **B. japonicus** Thunb. Culms erect or geniculate at base, 1½ to 2½ feet high; sheaths and blades soft-pubescent; panicle 5 to 8 inches long, broadly pyramidal, diffuse, somewhat drooping, the lower branches 3 to 5, slender; glumes rather broad, the first narrower, acute, 3-nerved, 2 to 3 lines long, the second obtuse, 5-nerved, 3 to 4 lines long; lemmas broad, obtuse, smooth, 9-nerved, the marginal pair faint, 3½ to 4½ lines long, the hyaline margin

obtusely angled above the middle, the apex emarginate; awns 4 to 5 lines long, somewhat twisted and strongly divaricate at maturity, those of the lower florets shorter than the upper; palea conspicuously shorter than the lemma.

A weed in waste places, Washington to California and Kansas, occasional in the Eastern States, introduced from Europe and the Orient. Wrights, *Hitchcock* in 1901; Mt. Pinos, *Hall* 6368.

Refs.—BROMUS JAPONICUS Thunb. Fl. Jap. 52. 1784. *B. patulus* Mert. & Koch, Deutschl. Fl. 1: 685. 1823.

6. **B. arenarius** Labill. Culms 6 to 18 inches high; sheaths and blades pilose; panicle pyramidal, open, nodding, the spreading branches and slender pedicels sinuously curved; glumes densely pilose, acute, scarious-margined, the first narrower, 3-nerved, 4 lines long, the second 7-nerved, 5 lines long; lemmas densely pilose, 7-nerved, 5 lines long, 2-toothed at apex; awn straight, 5 to 8 lines long.

Sandy roadsides, gravelly or sterile hills; San Bernardino Mts. to Mariposa and San Mateo cos.; introduced from Australia.

Ref.—BROMUS ARENARIUS Labill. Nov. Holl. Pl. 1: 23. 1804.

7. **B. brizaeformis** Fisch. & Mey. Culms 1 to 2 feet high; sheaths and blades pilose-pubescent; panicle 2 to 6 inches long, lax, secund, nodding; spikelets oblong-ovate, laterally much compressed, 7 to 12 lines long, about 5 lines wide; glumes broad, obtuse, smooth or minutely scabrous, the first 3 to 5-nerved, about ½ the length of the broader second, the second 5 to 9-nerved, 3 to 4 lines long; lemma 5 lines long, very broad, obtuse, smooth, with a broad scarious margin, awnless or nearly so.

Sandy fields and waste ground, occasional in the Western States, rare in the Eastern States, introduced from Europe. Gazelle, *Heller* 8075; Mt. Shasta, *Palmer* 2647 in 1892.

Ref.—BROMUS BRIZAEFORMIS Fisch. & Mey. Ind. Hort. Petrop. 3: 30. 1836.

8. **B. scoparius** L. Culms 8 to 12 inches high; sheaths and blades more or less pilose; panicle dense, oblong or ovate, obtuse, erect, 1 to 2½ inches long; spikelets short-pediceled, 5 to 11-flowered, 5 to 9 lines long; glumes glabrous, the first 1 to 3-nerved, 2 to 2½ lines long, the second 3-nerved, 2½ to 3 lines long; lemmas 5-nerved, 3½ to 4 lines long, usually smooth, bidentate; awn somewhat divaricate, 3½ to 4 lines long.

A rare introduction from Europe. Mariposa, *Congdon* in 1892; Santa Barbara, *Somes* 6.

Ref.—BROMUS SCOPARIUS L. Cent. Pl. 1: 6. 1755.

9. **B. madritensis** L. Culms tufted, 1 to 2 feet high; sheaths smooth or the lower slightly pubescent; blades puberulent or nearly smooth; panicle erect, 2 to 4 inches long, oblong-ovoid in outline, contracted and rather dense; glumes narrow, lanceolate, acuminate, the first 1-nerved, 4½ to 6 lines long, the second 3-nerved, 7 to 8 lines long; lemmas narrow, linear-lanceolate, 7 to 9 lines long, usually glabrous or merely scabrous, somewhat curved outward when old, distinctly 3 or faintly 5 to 7-nerved, with 2 acute hyaline teeth, 1 to 1½ lines long; awn rather stout, tapering, somewhat curved, 8 to 11 lines long.

Open ground and waste places, California to Oregon; introduced from Europe

Ref.—BROMUS MADRITENSIS L. Cent. Pl. 1: 5. 1755.

10. **B. villosus** Forsk. Culms 1½ to 2½ feet high; sheaths and blades pilose; panicle open, rather few-flowered, 3 to 5 inches long, the lower

branches ½ to 1 inch long; spikelets usually 5 to 7-flowered, 1½ to 2 inches long; glumes smooth, narrow, acuminate, the first 7 to 10 lines long, 1-nerved, the second 12 to 15 lines long, 3-nerved; lemmas 5-nerved, 12 to 15 lines long, scabrous or puberulent, 2-toothed, the teeth 1½ to 2 lines long; awn stout, 1½ to 2 inches long.

A weed in open ground and waste places, introduced from the Mediterranean region. Common from San Francisco south, infrequent northward.

Var. **gussonei** Aschers. & Graebn. Differs in having a more open panicle, the lower branches as much as 4 or 5 inches long.—Washington to California and Arizona, introduced from southern Europe. More common than the species in middle and northern California.

Refs.—BROMUS VILLOSUS Forsk. Fl. Aeg.-Arab. 23. 1775. *B. maximus* Desf. Fl. Atl. 1: 95. 1798; Thurb. in Wats. Bot. Cal. 2: 319. 1880; Davy in Jepson, Fl. W. Mid. Cal. 71. 1901. Var. GUSSONEI Aschers. & Graebn. Syn. Mitteleur. Fl. 2: 595. 1901. *B. maximus* Desf. var. *gussonii* Parl. Fl. Ital. 1: 407. 1848; Abrams, Fl. Los Ang. 54. 1904; Davy in Jepson, Fl. W. Mid. Cal. ed. 2. 70. 1911.

11. **B. rubens** L. Culms 6 to 15 inches high, puberulent below the panicle; sheaths and blades pubescent; panicle erect, compact, ovoid, usually purplish, 1½ to 3 inches long; spikelets 7 to 11-flowered, about 1 inch long; glumes narrow, acuminate, pubescent or sometimes smooth, the first 1-nerved, 3½ to 4½ lines long, the upper 3-nerved, 5 to 6 lines long; lemmas lanceolate, acute, 5-nerved, pubescent or smooth, 6 to 8 lines long, the apex deeply cleft into 2 long-acuminate hyaline teeth, 2 to 2½ lines long; awn straight, 9 to 11 lines long.

Dry hills and in waste or cultivated ground: common especially in middle and southern California; extends north to Washington, occasional elsewhere; introduced from southern Europe.

Refs.—BROMUS RUBENS L. Cent. Pl. 1: 5. 1755; Thurb. in Wats. Bot. Cal. 2: 319. 1880; Davy in Jepson, Fl. W. Mid. Cal. 71. 1901; Abrams, Fl. Los Ang. 54. 1904.

12. **B. tectorum** L. var. **nudus** Klett & Richter. Culms 1 to 2 feet high, smooth slender; sheaths and blades pubescent; panicle broad, rather dense, drooping, 2 to 6 inches long, the branches slender; spikelets nodding, linear, becoming cuneiform in flower, 6 to 10 lines long; glumes narrow, acute, glabrous, the first 1-nerved, 2 to 3 lines long, the second 3-nerved, 4 to 5 lines long; lemmas lanceolate, acute, glabrous, 5-nerved, 5 to 6 lines long, bidentate at apex; awn straight, 6 to 7 lines long.

Along roadsides, banks and waste places, introduced from Europe. B. tectorum is introduced here and there in the U. S. but has not been observed in California; it differs in having pubescent spikelets.

Locs.—Yreka, *Butler* 474, 816, 860; Montague, *Heller* 8012; Castella, *Piper* 6337; Tahoe, *Hitchcock* 3113; Northfork, *Griffiths* 4592; Santa Barbara, *Chase* 2571.

Ref.—BROMUS TECTORUM L. var. NUDUS Klett & Richter, Fl. Leipzig 109. 1830.

DIVISION II. Perennials. Spikelets terete or somewhat compressed, not strongly flattened.

13. **B. orcuttianus** Vasey. Culms erect, leafy below, nearly naked above, 2½ to 3½ feet high, pubescent at and below the nodes; sheaths pilose or more or less velvety; blades glabrous, rather short and erect; panicle narrow-pyramidal, erect, 4 to 6 inches long, the branches few, divaricate and rather rigid in fruit; spikelets 10 to 12 lines long, subterete, on short stout pedicels; glumes narrow, smooth or scabrous, the first acute, 3 to 4 lines long, 1-nerved, or sometimes with a faint lateral pair, the second broader, obtuse, 4 to 5 lines

long, 3-nerved; lemmas 5 to 6 lines long, narrow, scabrous or scabrous-pubescent over the back, the awn 2½ to 3½ lines long.

Open woods, California to Washington.

Locs.—Modoc Co., *Baker & Nutting*; Siskiyou Co., *Butler* 469; Mt. Shasta, *Hitchcock* 2912; Mt. Sanhedrin, *Heller* 5987; Truckee River, *Sonne* 21; Tahoe, *Hitchcock* 3091; Pioneer, *Hansen* 1835; Yosemite Nat. Park, *Hall & Babcock* 3401; Pine Ridge, *Hall & Chandler* 316; Northfork, *Griffiths* 6674; S. Fork Kaweah River, *Culbertson* 4512; Santa Catalina Island, *Brandegee* 62.

Var. **hallii** Hitchc. n. var. Blades soft-pubescent on both surfaces; glumes and lemmas pubescent.—(Laminae foliorum utrinque molliter pubescentes; glumae lemmataque pubescentia.)—Dry, mostly wooded ridges and slopes, 5000 to 9000 feet, California. Type (in the National Herbarium) collected by H. M. Hall in the San Jacinto Mts., 5700 feet altitude, June 27, 1901 (no. 2301).

Locs.—Blue Cañon, Placer Co., *Kellogg* 58 in part; Kaweah River, *Coville & Funston* 1346; Santa Lucia Mts., *Davy* 7709; Tassajara Hot Springs, *Elmer* 3314; San Bernardino Mts., *Wilder* 1071, 1131; San Jacinto Mts., *Hall* 2301, *Reed* 2449; "S. Calif.", *Palmer* 233 in 1888.

Refs.—BROMUS ORCUTTIANUS Vasey, Bot. Gaz. 10: 223. 1885, type from San Diego, *Orcutt* in 1884; Abrams, Fl. Los Ang. 55. 1904. *B. brachyphyllus* Merr. Rhodora 4: 146. 1902.

14. **B. grandis** Hitchc. n. comb. Culms 3 to 5 feet high; sheaths pubescent; blades pubescent, elongated, spreading, rather lax; panicle broad, open, the branches slender and drooping, naked below, the lower usually in pairs, as much as 6 inches long; first glume usually distinctly 3-nerved; lemmas densely pubescent over the back.

Dry hillsides at moderate altitudes, San Diego Co. to Madera and Monterey cos., also in Oregon and Washington. Resembles B. orcuttianus var. hallii, from which it differs in the open drooping panicle and the more distinctly 3-nerved first glume.

Locs.—Gavilan Peak, *Brewer* 740; Northfork, *Griffiths* 6596; S. Fork Kaweah River, *Culbertson* 4512; Little Sur, *Davy* 7385; Pico Blanco, *Davy* 7339; Santa Lucia Mts., *Davy* 7691; Tassajara Hot Springs, *Elmer* 3398; Topatopa Mts., *Abrams & McGregor* 161; Mt. Wilson, *Abrams* 2600; Little Santa Anita Cañon, *Abrams* 2632; San Bernardino, *Parish* 5038; Colorado Desert, *Palmer* in 1889; La Marte, *Orcutt* 472.

Refs.—BROMUS GRANDIS Hitchc. *B. orcuttianus* Vasey var. *grandis* Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 43. 1900. *B. porteri* Nash var. *assimilans* Davy, Univ. Cal. Publ. Bot. 1: 55. 1902, type *Hall* 2228 from San Jacinto Mts.

15. **B. vulgaris** Shear. Culms 3 to 4 feet high, the nodes pubescent; sheaths pilose; blades scattered, more or less pilose; panicle open, 4 to 6 inches long, the branches slender and drooping; spikelets slender, about an inch long; glumes narrow, sparsely pubescent, the first 1-nerved, 2½ to 4 lines long, acute, the second 3-nerved, broader and longer than the first, obtuse or acutish; lemmas 4 to 5 lines long, sparsely pubescent over back, pubescent or ciliate near the margins or nearly glabrous; awn 3 to 4 lines long.

Rocky woods and shady ravines, to 7000 feet, California to Vancouver and Montana.

Locs.—Humboldt Bay, *Chandler* 1177; Hubbard Sta., *Davy & Blasdale* 5406; Sherwood, *Hitchcock* 2700, 2708; Pt. Reyes, *Davy* 6853; Mill Valley, *Davy* 4126; Calaveras Co., *Hillebrand* 2258; Berkeley Hills, *Chase* 5668; Congress Springs, *Hitchcock* 2660; Santa Cruz, *Jones*; Santa Cruz Island, *Brandegee* 70; San Bernardino Mts., *Abrams* 2851.

Var. **eximius** Shear. Sheaths glabrous. Moist mountain sides, British Columbia to California. Sherwood Valley, *Davy & Blasdale* 5226; Mendocino plains, *Bolander* 4753.

Refs.—BROMUS VULGARIS Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 43. 1900. *B. purgans* L. var. *vulgaris* Hook. Fl. Bor. Am. 2: 252. 1840. *B. ciliatus* [L. misapplied by] Thurb. in Wats. Bot. Cal. 2: 320. 1880. Var. EXIMIUS Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 44. 1900.

16. **B. laevipes** Shear. Culms 2½ to 3 feet high, the base often decumbent and rooting; sheaths and blades glabrous; panicle broad, lax, drooping, 6 to 8 inches long, the branches slender, drooping; glumes smooth, the first 3-nerved, 3 to 4 lines long, the second 5-nerved, 5 to 6 lines long; lemmas obtuse, 7-nerved, 6 to 7 lines long, densely pubescent on the margin nearly to the apex and on the back at the base; awn 1½ to 2½ lines long.

Moist woods and shady banks, in the Coast Ranges from Humboldt Co. to San Diego; in Shasta and Lassen cos., and in the middle Sierra Nevada; extends north to Washington.

Refs.—BROMUS LAEVIPES Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 45. 1900; Davy in Jepson, Fl. W. Mid. Cal. 71. 1901. *B. richardsoni* [Link, misapplied by] Abrams, Fl. Los Ang. 55. 1904.

17. **B. suksdorfii** Vasey. Culms 2 to 3 feet high; sheaths and blades smooth, scattered; panicle narrow, erect, rather dense, 3 to 5 inches long, the branches erect or ascending; spikelets about an inch long, longer than the pedicels; glumes glabrous, the first 1-nerved, 4 to 5 lines long, the second 3-nerved, 5 to 6 lines long; lemmas 6 to 7 lines long, appressed-pubescent near margin and on the lower part of the midnerve.

Rocky woods and slopes, California to Washington.

Locs.—Donner Lake, *Heller* 7120; Mt. Tallac, *Hitchcock* 3131; Yosemite Nat. Park, *Hitchcock* 3303; Ebbetts Pass, *Brewer* 2088; Sequoia Nat. Park, *Hitchcock* 3365.

Ref.—BROMUS SUKSDORFII Vasey, Bot. Gaz. 10: 223. 1885.

DIVISION III. Annuals or perennials; spikelets large, strongly flattened, usually keeled; lemmas acuminate, usually awned.

18. **B. unioloides** H.B.K. RESCUE GRASS. Annual; culms 2 to 3 feet high; sheaths pilose; blades narrow, very scabrous; panicle open; spikelets about an inch long, 2½ to 4½ lines broad; glumes smooth, the first 5-nerved, 3½ to 5 lines long, the second 7-nerved, 5 to 6 lines long; lemmas acute, subcoriaceous, glabrous or scabrous, 6 to 8 lines long; awn 1 line long or less; palea ½ to ¾ as long as lemma.

Native country not certainly known, but probably the Andes, now distributed from Chile to southern U. S. Cultivated as a meadow grass in the Southern States under the name of Rescue Grass and Schrader's Brome Grass. Introduced in California.

Locs.—Palo Alto, *Congdon;* Bishop, *Heller* 8251; Kern Co., *Leckenby;* Pasadena, *Hitchcock* 2550; Fruitland, *Abrams* 1461; San Bernardino, *Parish* 4672; Mentone, *Leiberg* 3296.

Refs.—BROMUS UNIOLOIDES H.B.K. Nov. Gen. & Sp. 1: 151. 1816; Thurb. in Wats. Bot. Cal. 2: 322. 1880; Abrams, Fl. Los Ang. 56. 1904. Var. *haenkeanus* Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 52. 1900; Abrams, Fl. Los Ang. 56. 1904. *Ceratochloa haenkeana* Presl, Rel. Haenk. 1: 285. 1830.

19. **B. subvelutinus** Shear. Perennial; culms 1 to 2 feet high; sheaths canescent; blades narrow, rather rigid, becoming involute, canescent and also pilose; panicle 2 to 4 inches long, narrow, erect, the branches short, erect; spikelets about an inch long; glumes puberulent, the first 3 to 5-nerved, 4 to 5 lines long, the second 7-nerved, 5 to 6 lines long; lemmas appressed-puberulent, 6 to 7 lines long; awn 1½ to 2 lines long.

Dry wooded hills and meadows, California to Oregon and Wyoming.

Locs.—Goosenest Mt., *Butler* 842; Warner Mts., *Griffiths & Hunter* 399; N. E. Shasta Co., *Hall & Babcock* 4196; Eureka, *Davy;* East Oakland, *Davy;* Templeton, *Davy* 7587; Ft. Tejon, *Parish* 1995; Mt. Pinos, *Hall* 6635; San Bernardino Mts., *Hall* 7601; Laguna, *Schoenfeldt* 3624.

Ref.—BROMUS SUBVELUTINUS Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 52. 1900.

20. **B. marginatus** Nees. Short-lived perennial; culms rather stout, 2 to 4 feet high; sheaths pilose; blades broad, flat, more or less pilose; panicle erect, rather narrow, 4 to 8 inches long, the lower branches erect or somewhat spreading; spikelets 1 to 1½ inches long, 2½ to 3½ lines wide, 7 or 8-flowered; glumes broad, scabrous, or scabrous-pubescent, the first subacute, 3 to 5-nerved, 3½ to 4½ lines long, the second obtuse, 5 to 7-nerved, 4½ to 5½ lines long; lemmas subcoriaceous, coarsely pubescent, ovate-lanceolate, acute, 5½ to 7 lines long; awn 2 to 3½ lines long.

Open ground, open woods, roadsides and waste places, Riverside Co. to British Columbia, east to Alberta and Arizona.

Var. **seminudus** Shear. Sheaths glabrous; plant often tall and stout with large spreading panicle. Woods or near streams, mostly from 3000 to 9000 feet altitude. San Jacinto Mts. (*Hall* 785) north to British Columbia and east to Assiniboia and Colorado.

Refs.—BROMUS MARGINATUS Nees; Steud. Syn. Pl. Glum. 1: 322. 1854; Davy in Jepson, Fl. W. Mid. Cal. 72. 1901; Abrams, Fl. Los Ang. 56. 1904. *Ceratochloa breviaristata* [Hook. misapplied by] Thurb. in Wats. Bot. Cal. 2: 321. 1880. Var. SEMINUDUS Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 55. 1900.

21. **B. maritimus** Hitchc. n. comb. Differs from B. marginatus in having smooth sheaths, scabrous but not pilose blades, and narrow, strict panicle, the branches short and erect.

Near the coast from Sonoma Co. to Monterey Co.

Locs.—Bodega Pt., *Eastwood*; Pt. Reyes, *Davy* 6760, 6798, 6844; San Francisco, *Jones* 3270, *Lemmon, Michener & Bioletti*; Monterey, *Davy* 7281; Little Sur, *Davy* 7406.

Refs.—BROMUS MARITIMUS Hitchc. *B. marginatus* Nees var. *maritimus* Piper, Proc. Biol. Soc. Wash. 17: 148. 1905.

22. **B. carinatus** H. & A. Annual; culms 2 to 3 feet high; sheaths pilose; blades narrow, flat, more or less pilose; panicle pyramidal, rather lax, the lower branches spreading or drooping; spikelets about an inch long, 2½ lines wide, 5 to 9-flowered; glumes lanceolate, acute, glabrous or slightly scabrous-pubescent, the first 3-nerved, 3½ to 4½ lines long, the second 5-nerved, 4½ to 5½ lines long; lemmas lanceolate, puberulent or short-pubescent, 6½ to 8 lines long; awn 3½ to 5 lines long.

Open ground, open woods, roadsides and waste places, throughout the state, north to Washington.

Var. **californicus** Shear. Sheaths smooth, spikelets narrower than in the species.—Common in the Coast Ranges; infrequent in the Sierra Nevada and San Bernardino Mts.

Var. **hookerianus** Shear. Sheaths smooth; spikelets as broad as in the species.—Range about as in the last, less common.

Var. **linearis** Shear. Sheaths pubescent; blades very narrow, less than 1 line wide; panicle narrow, few-flowered.—Known only from California. Berkeley Hills, *Davy* 4245; above timber-line, Mt. Lyell, *Hitchcock* 3330.

Refs.—BROMUS CARINATUS H. & A. Bot. Beech. 403. 1841; Davy in Jepson, Fl. W. Mid. Cal. 72. 1901; Abrams, Fl. Los Ang. 56. 1904. Var. CALIFORNICUS Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 60. 1900. Var. HOOKERIANUS Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 60. 1900. *B. hookerianus* Thurb. in Wilkes, U. S. Expl. Exped. 17: 493. 1874; Davy in Jepson, Fl. W. Mid. Cal. ed. 2. 71. 1911. *Ceratochloa grandiflora* Hook. Fl. Bor. Am. 2: 253. 1840; Thurb. in Wats. Bot. Cal. 2: 321. 1880. Var. LINEARIS Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 61. 1900, type from California (without locality), *G. R. Vasey* in 1875

Tribe IX. HORDEAE.

63. **LOLIUM** L.

Spikelets several-flowered, solitary at each node of a continuous rachis, 1 edge of each spikelet placed against the rachis, the glume on that edge (the first glume) wanting, but both glumes present on the terminal spikelet. Glume narrow, rigid, 5 to 7-nerved, longer than the lower lemma, often exceeding the uppermost. Lemmas convex, 5 to 7-nerved, awned or awnless. Annuals or short-lived perennials with flat blades and spikelets scattered in terminal spikes.—Species 6, temperate Eurasia, introduced in America. (An ancient Latin name.)

Glume shorter than the spikelet.
  Lemmas awned ....1. *L. multiflorum.*
  Lemmas nearly or quite awnless ....2. *L. perenne.*
Glume as long or longer than the spikelet; annuals.
  Spikelets conspicuous ....3. *L. temulentum.*
  Spikelets hidden behind the appressed glumes ....4. *L. subulatum.*

1. **L. multiflorum** Lam. Italian Rye-grass. Australian Rye-grass. Short-lived perennial; culms 1 to 2 feet high, erect or often decumbent at base, often rough below the spike and on the convex portion of the rachis; spike as much as a foot long; spikelets as much as an inch long, twice as long as glume, 10 to 20-flowered; lemmas 3½ to 4 lines long, at least the upper awned.

Roadsides and waste places, mostly in the Coast Ranges; introduced from Europe, common on the Pacific Coast and frequent in the Eastern States. Frequently cultivated for lawns and as a meadow or pasture grass.

Refs.—Lolium multiflorum Lam. Fl. Franç. 621. 1778. *L. italicum* A. Br. Flora 17: 241. 1834; Thurb. in Wats. Bot. Cal. 2: 323. 1880. *L. perenne* L. var. *italicum* Parn. Grasses Brit. 298. 1845; Davy in Jepson, Fl. W. Mid. Cal. 75. 1901. Var. *multiflorum* "auct." [Parn.] Davy in Jepson, Fl. W. Mid. Cal. 75. 1901; Abrams, Fl. Los Ang. 58. 1904.

2. **L. perenne** L. Perennial Rye-grass. Resembling L. multiflorum, but usually more delicate, with narrower blades and smaller spikes; culm and convex surface of rachis smooth; spikelets usually 8 to 10-flowered, not much exceeding the glume; lemmas smaller, awnless.

Roadsides and waste places, throughout the cooler and moister portion of the U. S. Introduced from Europe. Sometimes cultivated as a lawn or pasture grass. Rare on the Pacific Coast.

Locs.—Mt. Shasta, *Palmer* 2639 in 1892; Ferndale, *Davy* 6200; Mendocino Co., *McMurphy* 421; Fresno Co., *Griffiths* 4712.

Var. **tenue** Kunth. Blades narrow, folded, firm, erect; spikes slender, the spikelets few-flowered.—Yreka, *Butler* 1563; near Mt. Shasta, *Palmer* 2612 in 1892.

Refs.—Lolium perenne L. Sp. Pl. 83. 1753; Thurb. in Wats. Bot. Cal. 2: 323. 1880; Davy in Jepson, Fl. W. Mid. Cal. 75. 1901; Abrams, Fl. Los Ang. 57. 1904. Var. tenue Kunth, Enum. 1: 436. 1833; Davy in Jepson, Fl. W. Mid. Cal. 75. 1901.

3. **L. temulentum** L. Darnel. Annual; culms 2 to 3 feet high; spike stout and strict, 6 to 8 inches long; glume about 1 inch long, as long or longer than the 5 to 7-flowered spikelet, firm, pointed; lemmas as much as 4 lines long, obtuse, awned; awn as much as 4 lines long.

Fields and waste places, rather common throughout the state and northward along the Pacific Coast, rare in the Eastern States; introduced from Europe.

Var. **arvense** Bab. Differs in having awnless spikelets.—Less common than the species, introduced from Europe.

Locs.—Hupa Valley, *Davy* 5690; Norman, *Davy* 4293; Yosemite Valley, *Hitchcock;* Ojai Valley, *Hubby* 52; Inglewood, *Abrams* 1183; Pasadena, *Hitchcock* 2555; San Bernardino, *Canby* 675; The Needles, *Jones;* San Diego, *Brandegee* 135.

Refs.—LOLIUM TEMULENTUM L. Sp. Pl. 83. 1753; Thurb. in Wats. Bot. Cal. 2: 323. 1880; Davy in Jepson, Fl. W. Mid. Cal. 75: 1901; Abrams, Fl. Los Ang. 58. 1904. Var. ARVENSE Bab. Man. Brit. Bot. 377. 1843. *L. arvense* With. Arr. Brit. Pl. ed. 3. 2: 168. 1796.

4. **L. subulatum** Vis. Annual; culms bushy-branched at base, stiffly spreading or prostrate; sheaths and blades smooth; spike stout, rigid, often curved; spikelets partially sunken in the excavations of the rachis and partially hidden by the appressed obtuse, strongly nerved glumes; lemmas 2½ lines long.

Introduced from Europe; rare. West Berkeley, *Pendleton* 449.

Ref.—LOLIUM SUBULATUM Vis. Fl. Dalm. 1: 90. 1842.

64. MONERMA Beauv.

Spikelets 1-flowered, solitary, imbedded in the joints of an articulated rachis, forming a slender cylindrical spike, and placed with the floret dorsi-ventral to the rachis as in Lolium. Glume of lateral spikelets solitary, coriaceous, gradually acuminate, longer than the lemma, the terminal spikelet with two glumes. Lemma membranaceous. Low cespitose annuals.—Species 3, of the Old World, 1 introduced in California. (Greek monos, single, and erma, support, on account of the single glume.)

1. **M. cylindrica** Coss. & Dur. Culms bushy-branched, spreading or prostrate, 4 to 12 inches long; spike cylindrical, curved, narrowed upward; glume 3 lines long, acuminate; lemmas 2½ lines long, pointed, scarious.

Salt marshes, San Francisco Bay south to San Diego; introduced from Europe.

Locs.—Pinole Creek Valley, *Davy* 6653; Ballona River, *Abrams* 2567; Oceanside, *Parish* 4446; San Diego, *Orcutt.*

Refs.—MONERMA CYLINDRICA Coss. & Dur. Expl. Algér. 2: 214. 1867. *Lepturus cylindricus* Trin. Fund. Agrost. 123. 1820; Davy in Jepson, Fl. W. Mid. Cal. 73. 1901; Abrams, Fl. Los Ang. 58. 1904. *Rottboellia cylindrica* Willd. Sp. Pl. 1: 464. 1797.

65. LEPTURUS R. Br.

Spikelets 1 or 2-flowered, solitary at the nodes, embedded in the articulated rachis. Glumes 2, placed in front of the spikelet and enclosing it, coriaceous, 5-nerved, acute, unsymmetrical, appearing like halves of a single split glume. Lemmas much smaller than the glumes, hyaline, keeled. Low annuals with slender spikes.—Species 5 or 6, eastern hemisphere, 1 introduced in California. (Greek leptos, slender, and oura, tail.)

1. **L. incurvatus** Trin. Culms tufted, decumbent at base, 4 to 8 inches high; blades short and narrow; spike 3 to 4 inches long, cylindrical, curved; spikelets 3½ lines long, pointed.

Mudflats and salt marshes, Marin Co. to San Diego; also adventive on ballast on the Atlantic Coast. Introduced from Europe.

Locs.—Pt. Reyes, *Davy* 6774; Martinez, *Davy* 6674; Santa Barbara, *Hitchcock* 2560; Ventura, *Chase* 5588; Santa Catalina Island, *Brandegee* 54; Old Town, *Abrams* 3544.

Refs.—LEPTURUS INCURVATUS Trin. Fund. Agrost. 123. 1820; Davy in Jepson, Fl. W. Mid. Cal. 73. 1901; Abrams, Fl. Los Ang. 58. 1904.

66. SCRIBNERIA Hack.

Spikelets 1-flowered, solitary or in pairs, sessile, placed with the floret lateral to the continuous rachis, forming slender spikes. Glumes 2, narrow, rigid, acute, slightly unequal, strongly keeled. Rachilla prolonged behind the floret as a very short stipe. Lemma shorter than the glumes, membranaceous, keeled, 2-toothed at apex, awned between the teeth, the callus hairy. Palea equaling or exceeding the lemma, acutely 2-toothed. A low slender annual with short narrow blades and slender spikes.—Species 1, California to Washington. (Prof. F. Lamson-Scribner, an eminent American agrostologist.)

1. **S. bolanderi** Hack. Culms 3 to 12 inches high, tufted, erect or ascending; spike slender, about ½ line thick, the joints 2 to 3 lines long.

Sandy or sterile ground, in the mountains, California to Washington; rare.

Locs.—Bigoak Flat, Tuolumne Co., *Congdon;* Wawona to Yosemite, *Chase* 5707; Mariposa, *Congdon;* Northfork, *Griffiths* 4585, 4600; Dunlap to Millwood, *Griffiths* 4659.

Refs.—Scribneria bolanderi Hack. Bot. Gaz. 11: 105. 1886; Davy in Jepson, Fl. W. Mid. Cal. 74. 1901. *Lepturus bolanderi* Thurb. in Wats. Bot. Cal. 2: 322. 1880, type from Russian River, *Bolander* 4669.

67. AGROPYRON Gaertn.

Spikelets several-flowered, solitary (or rarely in pairs), sessile, placed flatwise at each joint of the rachis, forming spikes. Glumes equal, firm, several-nerved, usually shorter than the spikelet, usually acute or awned. Lemmas convex, rather firm, 5 to 7-nerved, usually acute or awned from apex. Perennials.—Species about 35, in all temperate regions. (Greek agros, a field, and puros, wheat.)

- Plants producing rhizomes.
  - Lemmas scabrous-pubescent ....4. *A. subvillosum.*
  - Lemmas glabrous.
    - Blades thin and flat, sparsely hairy above..........2. *A. repens.*
    - Blades involute in drying, firm, glabrous.
      - Glumes obtuse..........1. *A. junceum.*
      - Glumes acuminate..........3. *A. smithii.*
- Plants not producing rhizomes.
  - Awn of lemma short or wanting.
    - Nodes pubescent; spikelets distant..........5. *A. parishii.*
    - Nodes glabrous; spikelets approximate..........7. *A. tenerum.*
  - Awn of lemma as long as body or longer.
    - Awn straight or slightly spreading.
      - Glumes awned; spikelets approximate..........8. *A. caninum.*
      - Glumes unawned; spikelets rather distant.
        - Glumes obtuse or notched; plant more than 3 feet tall..........6. *A. laeve.*
        - Glumes acute; plant less than 3 feet tall..........9. *A. vaseyi.*
    - Awn widely spreading or recurved.
      - Glumes acute, awnless..........10. *A. scabrum.*
      - Glumes awned.
        - Glumes 2-nerved, the awns long and recurved; axis readily disarticulating.
          - Culms erect..........11. *A. flexuosum.*
          - Culms ascending or spreading..........12. *A. scribneri.*
        - Glumes 3 to 5-nerved, the awns short, straight; axis not disarticulating..........13. *A. pringlei.*

1. **A. junceum** Beauv. Culms 1 to 2 feet high, decumbent at base, producing creeping rhizomes; blades involute, firm, smooth below; spike stout, easily disarticulating at the joints; spikelets compressed, smooth, 8 to 15 lines long; glumes oblong, obtuse, rather faintly many-nerved; lemmas obtuse, awnless, the midrib sometimes extending as a point.

Sandy sea-coast of Europe and North Africa. The only specimen from California was collected at the outlet of Lake Merced, near San Francisco, by J. W. Congdon. This is the form with large spikelets about 1 inch long (β macrostachyum Lange), which however is scarcely worthy of varietal rank.

Refs.—Agropyron junceum Beauv. Ess. Agrost. 102, 146. 1812. *Triticum junceum* L. Mant. 2: 327. 1771.

2. **A. repens** Beauv. QUACK-GRASS. Culms 1 to 4 feet high, from a bright yellow-green creeping scaly rhizome; blades thin, flat, sparsely pilose above; spike 2 to 6 inches long; spikelets about 5-flowered, 5 to 7 lines long; glumes 4 to 5 lines long, acuminate or awn-pointed, strongly nerved; lemmas 5 lines long, glabrous or scabrous, strongly nerved, pointed or awned.

A common and troublesome weed in the eastern U. S., rare on the Pacific coast; introduced from Europe. San Francisco in gardens, *Bolander* 1510.

Refs. AGROPYRON REPENS Beauv. Ess. Agrost. 102, 146. 1812. *Triticum repens* L. Sp. Pl. 86. 1753; Thurb. in Wats. Bot. Cal. 2: 323. 1880. *Agropyron richardsoni* [Schrad. misapplied by] Davy in Jepson, Fl. W. Mid. Cal. 76. 1901.

3. **A. smithii** Rydb. Plant usually glaucous, from gray or tawny creeping scaly rhizomes; culms 1 to 5 feet high, rigid; blades bluish green, scabrous, firm, striate, becoming involute; spikelets 7 to 13-flowered, somewhat distant, glabrous or nearly so, acute, compressed, divergent, sometimes in pairs; glumes acuminate, ½ to ⅔ as long as spikelet, the nerves usually faint; lemmas mucronate or awn-pointed, hard, faintly nerved.

Dry, especially alkaline soil; Modoc Co. (Smoke Creek, *Griffiths & Hunter* 489) north to Vancouver Island and east to Michigan and Kansas.

Refs. AGROPYRON SMITHII Rydb. Mem. N. Y. Bot. Gard. 1: 64. Feb. 1900. *A. occidentale* Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 27: 9. Dec. 1900.

4. **A. subvillosum** E. Nels. Culms 1½ to 3 feet high, from creeping rhizomes; blades narrow, mostly involute, scabrous; spike erect, 2 to 5 inches long; spikelets few-flowered, about ½ inch long; glumes lanceolate, the first narrow, 3 to 5-nerved, 4 lines long, the second broader, 5 to 7-nerved, 4½ lines long; lemmas 4 to 5 lines long, more or less scabrous-pubescent, acute or awn-pointed.

Lassen Co. (mountains south of Dixie Valley, *Baker & Nutting* in 1894) north to Washington and east to Saskatchewan and Colorado.

Refs. AGROPYRON SUBVILLOSUM E. Nels. Bot. Gaz. 38: 378. 1904. *Triticum repens* L. var. *subvillosum* Hook. Fl. Bor. Am. 2: 254. 1840.

5. **A. parishii** Scribn. & Smith. Culms 3 to 4 feet high, without rhizomes, the nodes pubescent; blades flat; spike narrow, as much as foot long; spikelets-narrow, distant, mostly shorter than the internodes of the rachis, about ¾ inch long; glumes about 8 lines long, several-nerved, acute, more than ½ as long as spikelet; lemmas smooth, faintly nerved, short-awned or awn-pointed

Only known from California. Pico Blanco, Monterey Co., *Davy* 7364; San Bernardino Mts., *Parish* 2054, 2238, 4180.

Refs. AGROPYRON PARISHII Scribn. & Smith, U. S. Dept. Agr. Div. Agrost. Bull. 4: 28. 1897, type *Parish* 2054; Abrams, Fl. Los Ang. 59. 1904.

6. **A. laeve** Hitchc. n. comb. Culms 4 to 5 feet high, without rhizomes; blades flat; spike as much as a foot long; spikelets distant, usually shorter than the internodes of the rachis; glumes obtuse, several-nerved, about 5 lines long; lemmas about 5 lines long, long-awned; awn ½ to 1 inch long.

Only known from California. Clinton, *Hansen* 1767; Dunlap to Millwood, *Griffiths* 4686; "Ex. Herb. State Normal School, San Jose, *Norton* in 1879."

Refs. AGROPYRON LAEVE Hitchc. *A. parishii* Scribn. & Smith var *laeve* Scribn. & Smith, U. S. Dept. Agr. Div. Agrost. Bull. 4: 28. 1897, type *Palmer* 414 in Gray Herbarium collected in 1875 at Fowley's, Cuyamaca Mts.; Abrams, Fl. Los Ang. 59. 1904.

7. **A. tenerum** Vasey. Culms erect, tufted, 2 to 4 feet high, without rhizomes; blades narrow, flat or involute; spike cylindrical, slender, erect, 4 to

6 inches long; glumes firm, nearly as long as the spikelet, gradually tapering into an awned point; lemmas short-awned.

Open woods, rocky slopes and upland plains, in the region of Mt. Shasta, in the Sierra Nevada and in the southern mountains; also in Yolo Co. (*Blankinship* 43) and San Mateo Co. (*Bolander* 1512); extends north to Alaska and east to Labrador and New England. The following specimens have thicker spikes with more imbricated spikelets, the form (var. longifolium) to which the name A. pseudorepens has sometimes been misapplied: Woodland, *Blankinship* 43; Yreka, *Butler* 850; San Bernardino Mts., *Hall* 7659; Mt. Pinos, *Hall* 6418.

Refs.—AGROPYRON TENERUM Vasey, Bot. Gaz. 10: 258. 1885; Davy in Jepson, Fl. W. Mid. Cal. 76. 1901. Var. *longifolium* Scribn. & Smith, U. S. Dept. Agr. Div. Agrost. Bull. 4: 30. 1897. *Triticum violaceum* [Hornem. misapplied by] Thurb. in Wats. Bot. Cal. 2: 324. 1880. *Agropyron caninum* L. var. *tenerum* Pease & Moore, Rhodora 12: 71. 1910.

8. **A. caninum** Beauv. Culms erect, 1 to 3 feet high, without rhizomes; blades flat, rather lax, 1 to 3 lines wide, scabrous; spike more or less nodding at apex, rather dense, 3 to 6 inches long; spikelets 6 to 7 lines long; glumes pointed or awned; lemmas 3 to 5-nerved; awn straight, or somewhat spreading, once or twice the length of the lemma.

Dry hillsides and mountain meadows, in the Sierra Nevada and southern mountains, also in the Santa Lucia Mts. (*Davy* 7647, 7713); extends east to Colorado and north to Alaska and Greenland.

Refs.—AGROPYRON CANINUM Beauv. Ess. Agrost. 102. 1812. *Triticum caninum* L. Sp. Pl. 86. 1753; Thurb. in Wats. Bot. Cal. 2: 324. 1880.

9. **A. vaseyi** Scribn. & Smith. Culms slender, 2 to 3 feet high, without rhizomes; blades narrow, involute, erect, smooth; spike slender, 2 to 4 inches long; spikelets rather distant, 5 to 8 lines long; glumes 3 to 5 lines long, acute, but not awned, thin, scarious at margin and tip, strongly 3 to 5-nerved; lemmas faintly nerved, terminating in a slender, finally horizontally spreading awn as much as ¾ inch long.

Rocky or arid hillsides, northeastern California to Alberta, Montana and New Mexico.

Locs.—Klamathon, *Copeland* 3542; Forestdale, *Baker & Nutting, Davy;* Warner Mts., *Griffiths & Hunter* 464; Modoc Nat. For., *Hatton* 150; Jess Valley to Blue Lake, Modoc Co., *Griffiths & Hunter* 402; Dixie Mts., *Baker & Nutting;* Amedee, *Davy.*

Refs.—AGROPYRON VASEYI Scribn. & Smith U. S. Dept. Agr. Div. Agrost. Bull. 4: 27. 1897. *Triticum strigosum* [Lessing, misapplied by] Thurb. in Wats. Bot. Cal. 2: 324. 1880. The specimen in the Gray Herbarium described by Thurber was collected by J. G. Lemmon in "Sierra, Nevada Co."

10. **A. scabrum** Beauv. Culms 3 to 4 feet high, without rhizomes; blades flat; spike 6 to 8 inches long; spikelets rather distant, about ¾ inch long; glumes about ½ inch long, about 7-nerved, short-awned; lemmas about ½ inch long, faintly nerved, terminating in a long stout spreading awn as much as 1½ inches long.

The only specimen seen is Bolander's no. 6468, collected south side of Eel Ridge. It agrees fairly well with a specimen from Hunter's River, New South Wales, collected by the Wilkes Expedition, but differs from most of the Australian specimens of A. scabrum in having longer glumes. It resembles A. arizonicum Scribn. & Smith, which, however, has shorter glumes. The California specimen is tentatively referred to the Australian A. scabrum until the species can be more thoroughly studied.

Refs.—AGROPYRON SCABRUM Beauv. Ess. Agrost. 102. 1812; Davy in Jepson, Fl. W. Mid. Cal. 76. 1901. *Triticum scabrum* R. Br. Prodr. 178. 1810. *Festuca scabra* Labill. Nov. Holl. Pl. 1: 22. 1804.

11. **A. flexuosum** Piper. Culms 2 to 3 feet high, slender, without rhizomes; sheaths smooth; blades short, flat or loosely involute; spike 3 to 4 inches long, flexuous, long-exserted, the rachis disarticulating; spikelets sometimes in pairs; glumes subulate or narrowly lanceolate, mostly 2-nerved, narrowed into a slender spreading awn ½ to 1 inch long; lemmas 4 lines long, smooth and rounded below, 5-nerved and somewhat scabrous above, tipped with a slender spreading awn about an inch long.

Mountain slopes, Modoc Co. (Warner Mts., *Griffiths & Hunter* 468) to Washington and Idaho.

Refs.—AGROPYRON FLEXUOSUM Piper, Proc. Biol. Soc. Wash. 18: 149. 1905. *Sitanion flexuosum* Piper, Erythea 7: 99. 1899.

12. **A. scribneri** Vasey. Culms ascending or spreading, ½ to 1½ feet high; blades short, flat, rather thin, mostly basal; spike short and thick, 1 to 2 inches long, readily disarticulating at the joints; spikelets rather closely imbricated, somewhat divergent, about 5 lines long, few-flowered; glumes narrow, rigid, 2-nerved, gradually narrowed into a horizontally spreading awn ½ to ¾ inch long; lemmas nerved toward tip, terminating in awns similar to those of the glumes but somewhat longer.

Rocky slopes, mostly above 9000 feet, Mt. Dana (*Congdon* in 1898) to Montana and south to Arizona and New Mexico.

Ref.—AGROPYRON SCRIBNERI Vasey, Bull. Torr. Club 10: 128. 1883.

13. **A. pringlei** Hitchc. n. comb. Culms 1 to 1½ feet high; blades usually flat, short; spike 2 to 4 inches long, not disarticulating, the spikelets falling from the rachis; glumes lanceolate, 3 to 5-nerved, ending in a short straight awn; lemmas ending in stout horizontally spreading awns about ¾ inch long.

Gravelly slides and rocky slopes at 7000 to 12,000 feet elevation in the Sierra Nevada; also in Wyoming.

Locs.—Webber Lake, *Leiberg* 5244; Carson Pass, *Brewer* 2118; Mt. Tallac, *Hitchcock* 3152; Pyramid Peak, *Hall & Chandler* 4718; Sequoia Nat. Park, *Hitchcock* 3385; Little Kern River, *Purpus* 5515.

Refs.—AGROPYRON PRINGLEI Hitchc. *A. gmelini* Scribn. & Smith var. *pringlei* Scribn. & Smith, U. S. Dept. Agr. Div. Agrost. Bull. 4: 31. 1897, type from above Summit Valley, *Pringle*.

68. **HORDEUM** L. WILD BARLEY.

Spikelets 1-flowered, 3 together at each joint of the rachis, the middle one sessile and perfect, the lateral usually pediceled, often reduced to awns. Glumes equal, rigid, narrow-lanceolate, subulate or setaceous, usually elongated and awn-like, the 3 pairs simulating an involucre around the central perfect floret. Rachilla prolonged behind the palea as an awn, sometimes with a rudimentary floret. Lemma of central floret obscurely 5-nerved, tapering into an awn. Palea with its back toward the rachis. Cespitose annuals or perennials with dense terminal bristly spikes disarticulating at maturity, the joints falling with the spikelets attached.—Species about 16, temperate regions of both hemispheres. (The ancient Latin name for barley.)

Plants perennial; awns as much as 2 inches long. . . . . .1. *H. jubatum.*
Plants annual.
  Glumes or some of them ciliate. . . . . .5. *H. murinum.*
  Glumes not ciliate.
    Glumes of fertile spikelet dilated above the base. . . . . .2. *H. pusillum.*
    Glumes not dilated.
      Glumes very scabrous . . . . .3. *H. nodosum.*
      Glumes glabrous or minutely scabrous . . . . .4. *H. gussoneanum.*

1. **H. jubatum** L. Perennial; culms erect, or decumbent at base, 1 to 2 feet high; blades 2½ lines wide, scabrous; spike nodding, 2 to 4 inches long, about an inch wide, soft; lateral pair of spikelets each reduced to 1 to 3 spreading awns; glumes of perfect spikelets awn-like, 1 to 2½ inches long, spreading; lemma 3 to 4 lines long with an awn as long as the glumes.

Open ground, fields and waste places, north to Alaska and east to Ontario and Kansas; often a troublesome weed in alfalfa fields in the Rocky Mountain region.

Locs.—Honey Lake Valley, *Davy* 3299; Suisun marshes, *Davy* 4118; Lancaster, *Elmer* 3518; San Bernardino Mts., *Parish Bros.* 1540.

Refs.—HORDEUM JUBATUM L. Sp. Pl. 85. 1753; Thurb. in Wats. Bot. Cal. 2: 325. 1880.

2. **H. pusillum** Nutt. Annual; culms 4 to 15 inches high; blades erect, flat; spike erect, 1 to 3 inches long, 5 to 7 lines wide; lateral pair of spikelets abortive, the first glume of each and both glumes of the fertile spikelet dilated above the base, attenuate into a slender awn 4 to 7 lines long; glumes very scabrous; lemma unawned.

Plains and open, especially alkaline ground: San Diego, *Baker* 3682, *Orcutt* 1175; Santa Catalina Island, *Trask;* north to Idaho and eastward to Ohio.

Ref. HORDEUM PUSILLUM Nutt. Gen. Pl. 1: 87. 1818.

3. **H. nodosum** L. Similar to H. pusillum, but usually taller; all the glumes awn-like.

Fields, waste places, and open ground throughout the state, north to Alaska and east to Indiana; introduced from Eurasia and abundantly naturalized.

Refs.—HORDEUM NODOSUM L. Sp. Pl. ed. 2. 1: 126. 1762; Thurb. in Wats. Bot. Cal. 2: 325. 1880; Davy in Jepson, Fl. W. Mid. Cal. 82. 1901; Abrams, Fl. Los Ang. 60. 1904. Var. *depressum* Scribn. & Smith, U. S. Dept. Agr. Div. Agrost. Bull. 4: 24. 1897; Abrams, Fl. Los Ang. 60. 1904.

4. **H. gussoneanum** Parl. Annual; culms numerous, spreading or geniculate at base, 6 to 15 inches high; sheaths and flat blades, especially the lower, more or less pubescent; spike erect, oblong, ½ to 1½ inches long, 3 to 5 lines wide, rounded at base; glumes setaceous, glabrous or minutely scabrous, about ½ inch long; lemma of lateral spikelets small, narrowed into an awn about 1½ lines long; lemma of central spikelet 2½ lines long, the awn somewhat longer than the glumes.

Fields and waste places, common, north to Vancouver Island and east to Idaho; introduced from Europe.

Refs.—HORDEUM GUSSONEANUM Parl. Fl. Palerm. 1: 246. 1845; Abrams, Fl. Los Ang. 60. 1904. *H. maritimum* With. var. *gussoneanum* Richt. Pl. Eur. 1: 131. 1890; Davy in Jepson, Fl. W. Mid. Cal. 83. 1901. *H. maritimum* With. is mentioned by Abrams as growing along the coast at San Diego (Fl. Los Ang. 60. 1904).

5. **H. murinum** L. Annual; culms bushy-branched, spreading; sheaths and blades smooth; spike 2 to 3 inches long, often partially enclosed by the uppermost inflated sheath; glumes of the central spikelet narrowly spindle-form, 3-nerved, long-ciliate on both margins, the nerves scabrous; awn about an inch long; glumes of the lateral spikelets unlike, the inner similar to the central, the outer setaceous, not ciliate; lemmas all broad, 4 to 5 lines long, the awns somewhat exceeding those of the glumes.

Fields, waste places, and open ground, throughout the state, north to Vancouver Island and east to Idaho and New Mexico, rare in the Eastern States; introduced from Europe.

Refs.—HORDEUM MURINUM L. Sp. Pl. 85. 1753; Thurb. in Wats. Bot. Cal. 2: 325. 1880; Davy in Jepson, Fl. W. Mid. Cal. 83. 1901; Abrams, Fl. Los Ang. 60. 1904.

69. ELYMUS L.

Spikelets 2 to 6-flowered, in pairs, sessile at the joints of a continuous rachis, rarely single or more than two together. Glumes equal, usually narrow and rigid, 1 to 3-nerved, acute or awned, placed at the sides or close together in front of the florets. Lemmas convex, obscurely 5-nerved, usually acute or awned from the apex. Erect perennials (except E. caput-medusae) with terminal often bristly spikes.—Species about 25, in temperate regions of both hemispheres. (Greek elumos, an ancient name for a kind of millet.)

Plants annual . . . . .1. *E. caput medusae.*
Plants perennial.
  Glumes subulate, nearly or quite nerveless.
    Lemmas pubescent; plant cinereus-pubescent . . . . .2. *E. cinereus*
    Lemmas glabrous or hispidulous.
      Plant stout and tall; blades usually more than 4 lines wide, flat; rhizomes thick; spike dense . . . . .3. *E. condensatus*
      Plant slender; blades usually less than 2½ lines wide, involute; rhizome slender; spike slender . . . . .4. *E. triticoides.*
  Glumes lanceolate, distinctly nerved.
    Plant producing rhizomes . . . . .5. *E. arenarius.*
    Plant not producing rhizomes.
      Awn of lemma a short point . . . . .6. *E. pubescens.*
      Awn of lemma once or twice as long as body . . . . .7. *E. glaucus.*

1. **E. caput-medusae** L. Annual; culms branched at base, erect or decumbent at base, slender, 8 inches to 2 feet high; blades narrow and short; spike 1 to 2 inches long, long-awned; glumes awl-shaped, smooth, indurated below, narrowed into a slender awn ½ to 1 inch long; lemmas lanceolate, 3-nerved, 3 lines long, flat, very scabrous, gradually narrowed into a flat awn, 2 to 4 inches long.

Open ground, California to Washington; introduced from Europe. Klamathon, *Copeland* 3493; Los Gatos, *Hitchcock* 2631.

Ref.—ELYMUS CAPUT-MEDUSAE L. Sp. Pl. 84. 1753.

2. **E. cinereus** Scribn. & Merr. Culms erect, stout, puberulent, 4 to 5 feet high; sheaths and blades cinereus-pubescent, the latter with an indurated point; spike erect, 6 to 8 inches long, dense, interrupted below; spikelets 7 to 9 lines long; glumes subulate, about ½ inch long, scabrous-pubescent; lemmas scabrous-pubescent, especially the apex, faintly nerved, obtuse, mucronate or with a short awn-point.

The type is from Pahrump Valley, Nevada. The only specimen seen from California is from Lancaster, *Elmer* 3662.

Ref.—ELYMUS CINEREUS Scribn. & Merr. Bull. Torr. Club 29: 467. 1902.

3. **E. condensatus** Presl. Culms in large tufts, stout, 3 to 6 feet high, producing stout knotty rhizomes; sheaths smooth; blades flat, as much as 10 lines wide; spike erect, usually dense, as much as a foot long, sometimes branched; glumes narrowly lanceolate or subulate, awn pointed, usually only 1-nerved, or nerveless; about as long as the first lemma; lemmas awnless or mucronate.

Dry plains and hillsides and along gullies and ditches, southern California to British Columbia and Alberta, and east to Nebraska. In California found especially in the coastal region from San Francisco southward. A botanic garden specimen from Davy, said to have been cultivated at Berkeley from seed from San Emigdio Cañon, Kern Co., and a second cultivated specimen of which the source is not given, have very compound panicles, about 13 inches long and 3 inches wide.

Var. **pubens** Piper. Sheaths and blades pubescent.—Santa Barbara, *Hitchcock* 2582; also in Washington.

Refs.—Elymus condensatus Presl, Rel. Haenk. 1: 265. 1830, type from Monterey, *Haenke;* Thurb. in Wats. Bot. Cal. 2: 326. 1880; Davy in Jepson, Fl. W. Mid. Cal. 78. 1901; Abrams, Fl. Los Ang. 61. 1904. Var. pubens Piper, Erythea 7: 101. 1901.

4. **E. triticoides** Buckl. Culms usually glaucous, 2 to 4 feet tall, usually in large masses, from extensively creeping, scaly rhizomes; sheaths smooth or scabrous; blades narrow, mostly 1 to 3 lines wide, flat or soon involute; spike erect, slender, sometimes branched; glumes subulate, 5 to 7 lines long; lemmas 3 to 5 lines long, glabrous, short-pointed.

Moist bottomland and alkaline soil, throughout the state, commoner in the southern portion; north to Washington and east to Colorado and Arizona.

Var **pubescens** Hitchc. n. var. Sheaths and involute blades hirsute-pubescent. —(Et laminae involutae et vaginae hirsutae.)—Type in the National Herbarium, collected at Griffin, Ventura Co., by Elmer (no. 3748). No other specimens have been observed.

Refs.—Elymus triticoides Buckl. Proc. Acad. Phila. 1862: 99. 1863; Davy in Jepson, Fl. W. Mid. Cal. 78. 1901; Abrams, Fl. Los Ang. 61. 1904. *E. condensatus* Presl var. *triticoides* Thurb. in Wats. Bot. Cal. 2: 326. 1880. *E. orcuttianus* Vasey, Bot. Gaz. 10: 258. 1885, type from San Diego, *Orcutt;* Abrams, Fl. Los Ang. 62. 1904. *Agropyron arenicolum* Davy in Jepson, Fl. W. Mid. Cal. 76. 1901, type from Pt. Reyes, *Davy* 6879; the following dwarfed seacoast specimens, 6 to 10 inches high, also belong to this: Pt. Reyes, *Davy* 6781; mouth of Salinas River, *Davy* 7548; Pacific Grove, *Hitchcock* 2608; Monterey, *Davy* 7272; Pt. Sur, *Davy* 7752.

5. **E. arenarius** L. Culms stout, smooth, or pubescent above, glaucous, 2 to 4 feet high from creeping rhizomes; sheaths and blades smooth or the latter scabrous above; spike erect, dense, 3 to 10 inches long; glumes lanceolate, flat, many-nerved, scabrous or pubescent, 5 to 10 lines long, acuminate, awnless, about as long as the spikelet; lemmas about as long as glumes, scabrous or felty-pubescent, acuminate or mucronate.

Sand dunes along the coast: Santa Cruz, *Anderson;* San Mateo Co., *Elmer* 4770; Westport, *Congdon.* Northern coasts of North America and Eurasia.

Refs.—Elymus arenarius L. Sp. Pl. 83. 1753; Thurb. in Wats. Bot. Cal. 2: 326. 1880; Davy in Jepson, Fl. W. Mid. Cal. 77. 1901.

6. **E. pubescens** Davy. Culms 1 to 3 feet high; scabrous, sheaths scabrous and pubescent; blades flat or loosely involute, short; spike 2 to 4 inches long; glumes linear-lanceolate, flat, acuminate, unawned, about 6 lines long, scabrous, about 5-nerved; lemmas scarcely as long as the glumes, short-awned.

Pt. Arena, *Davy* 6028 (the only specimen in the National Herbarium), to Pt. Reyes.

Ref.—Elymus pubescens Davy in Jepson, Fl. W. Mid. Cal. 78. 1901, type from Pt. Reyes, *Davy*.

7. **E. glaucus** Buckl. Culms erect, 2 to 4 feet high, without rhizomes; sheaths smooth or scabrous; blades flat, as much as 5 lines wide, scabrous on both surfaces, sometimes narrow and more or less involute; spike erect, usually dense, long-exserted, 2 to 6 inches long, rarely longer; glumes about as long as the spikelet, lanceolate, 4 to 6 lines long, acuminate or awn-pointed, with 2 to 4 scabrous nerves; lemmas awned, the awn 1 to 2 times as long as the body.

Open woods, copses, and dry hillsides, throughout the state, north to Alaska and east to Michigan and Missouri.

Var. **jepsoni** Davy. Distinguished by the more or less pubescent sheaths and blades.—Dry woods and ravines, known only from California.

Locs.—Ft. Bragg, *Davy & Blasdale* 6136; Albion, *Davy & Blasdale* 6065; Cloverdale, *Hitchcock* 2684; San Rafael, *Bolander* 2284; Mt. Tamalpais, *Piper* 6312; Yosemite Nat. Park, *Hitchcock* 3353; Northfork, *Griffiths* 6650; Acton, *Elmer* 3750; San Bernardino Mts., *Abrams* 2762; San Jacinto Mts., *Parish Bros.* 1014.

Refs.—ELYMUS GLAUCUS Buckl. Proc. Acad. Phila. 1862: 99. 1863; Davy in Jepson, Fl. W. Mid. Cal. 78. 1901; Abrams, Fl. Los Ang. 62. 1904. *E. sibiricus* [L. misapplied by] Thurb. in Wats. Bot. Cal. 2: 326. 1880. *E. angustifolius* Davy in Jepson, Fl. W. Mid. Cal. 80. 1901, type from San Francisco, *Davy*. Var. *caespitosus* Davy in Jepson, Fl. W. Mid. Cal. 81. 1901, type from Berkeley Hills, *Davy*. *E. glaucus* Buckl. var. *breviaristatus* Davy in Jepson, Fl. W. Mid. Cal. 79. 1901, type from Pt. Reyes, *Davy*. Var. *maximus* Davy in Jepson, Fl. W. Mid. Cal. 79. 1901, type from Napa Valley, *Jepson*. Var. *tenuis* Vasey, Contr. Nat. Herb. 1: 280. 1893. Var. JEPSONI Davy in Jepson, Fl. W. Mid. Cal. 79. 1901, type from Napa Valley, *Jepson*. *E. hispidulus* Davy in Jepson, Fl. W. Mid. Cal. 79. 1901, type from Olema, *Davy* 4306b. *E. divergens* Davy in Jepson, Fl. W. Mid. Cal. 80. 1901, type from Petaluma, *Davy* 4037. *E. velutinus* Scribn. & Merr. Bull. Torr. Club 29. 466. 1902, type from Deep Creek, San Bernardino Mts., *Abrams* 2056. *E. parishii* Davy & Merr. Univ. Cal. Publ. Bot. 1: 58. 1902, type from Mt. San Jacinto, *Hall* 2097.

Elymus glaucus is variable in habit and some of its forms, as seen from the above synonymy, have received varietal names and others have been considered distinct species. Var. *breviaristatus* Davy has short-awned spikelets; var. *tenuis* Vasey is a slender form; var. *maximus* Davy is a large form with blades as much as 8½ lines wide. *Elymus angustifolius* Davy and *E. angustifolius* var. *caespitosus* Davy appear to be narrow-leaved forms of E. glaucus. I have been unable satisfactorily to separate any of these as distinct species.

70. SITANION Raf.

Spikelets 2 to several-flowered, in 2's or 3's, rarely solitary, at each joint of the articulate rachis. Glumes entire, bifid or several-parted, narrow or setaceous, long-awned. Lemmas long-awned. Tufted perennials with bristly, readily disarticulating spikes.—Species about 12, western North America. (Greek sitos, grain for food.)

Glumes cleft or parted into 3 to many lobes.
  Awn of lemma 1½ to 4 inches long.......................2. *S. jubatum.*
  Awn of lemma 7 to 10 lines long.......................3. *S. breviaristatum.*
Glumes entire or 2-cleft or 2-parted.
  Glumes, or some of them, 3-nerved.......................1. *S. hanseni.*
  Glumes 2-nerved.
    Glumes entire.......................6. *S. californicum.*
    Glumes, or some of them, bifid.
      Plants alpine, mostly less than 8 inches high; awns usually about 1 inch long.......4. *S. minus.*
      Plants of medium altitudes, mostly more than 8 inches tall; awns usually 1½ to 2 inches long.......................5. *S. glabrum.*

1. **S. hanseni** J. G. Smith. Culms rather slender, loosely tufted; sheaths smooth or scabrous; blades flat or involute; spike rather slender, 2 to 3 inches long; glumes narrowly lanceolate, some of them 1-nerved and entire, others broader and 3-nerved, often bifid; lemmas smooth, scabrous toward apex, 4 lines long; awns erect, about an inch long.

A rare species only known from California. The habitat is not given on any of the specimens cited below.

Locs.—Agricultural Station, Amador Co., *Hansen* 1742; Santa Lucia Mts., *Davy* 7717; Tassajara Hot Springs, *Elmer* 3307; Templeton, *Davy* 7583, 7586, 7592, 7593, 7594; Temescal Mts., *Abrams* 1814.

Refs.—SITANION HANSENI J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 20. 1899, based on *Elymus hanseni*. *Elymus hanseni* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 56. 1898, type *Hansen* 1742. *Sitanion anomalum* J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 20. 1899, type from Pasadena, *Allen;* Abrams, Fl. Los Ang. 64. 1904.

2. **S. jubatum** J. G. Smith. Culms erect, 1 to 2 feet high, rarely taller; sheaths smooth, scabrous or villous-pubescent; blades flat, often becoming involute, smooth or usually more or less pubescent, at least on upper surface, usually not over 1½ lines wide; spike erect, dense, 1 to 3 inches long, thick and bushy from the numerous long awns; glumes split into 3 or more lobes or divisions, each extending into a long awn; lemmas mostly 4 to 5 lines long, smooth, or scabrous toward apex, the awns and those of the glumes 1½ to 4 inches long.

Rocky or brushy hillsides and open dry woods and plains, California to Washington.

As here understood the species includes the following.—The original *S. jubatum* of Washington, with tall stout culms and large spikes with awns about 4 inches long (Ojai Valley, Ventura Co. *Hubby* 48): *S. villosum*, with villous-pubescent leaves, and awns 2 to 3 inches long (Modoc Co., *Davy;* Sonoma Co., *Samuels* 225; Solano Co., *Heller* 5580; Alameda Co., *Brewer* 1220; Santa Clara Co., *Elmer* 5047; Stanislaus Co., *Elmer* 4852; Northfork, *Griffiths* 4634; Santa Lucia Mts., *Davy* 7681; Templeton, *Davy* 7601; Tehachapi, *Chase* 5742; Ramona, *Brandegee* 88): *S. multisetum*, similar to *S. jubatum* but culms lower and awns shorter, common in the Coast Ranges from the San Francisco Bay region southward, intergrading with the typical form and also with *S. villosum:* and *S. polyanthrix*, more or less pubescent, and having awns 1½ to 2 inches long, a few scattered specimens resembling the type of *S. polyanthrix* (Yreka, *Butler* 823; Modoc Co., *Griffiths & Hunter* 482; Dixie Mts., *Davy;* Vacaville, *Jepson* 4247; Los Gatos, *Heller* 7498, *Hitchcock* 2640; Mariposa Co., *Congdon;* Cuyamaca Mts., *Brandegee* 111). The California specimens so intergrade that it has been impossible to separate satisfactorily these forms.

Refs.—SITANION JUBATUM J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 10. 1899; Abrams, Fl. Los Ang. 63. 1904. *S. villosum* J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 11. 1899. *S. multisetum* J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 11. 1899, type *Coville & Funston* 1121; Abrams, Fl. Los Ang. 63. 1904. *S. polyanthrix* J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 12. 1899, based on *Polyanthrix hystrix*. *Polyanthrix hystrix* Nees, Ann. Nat. Hist. 1: 284. 1838, type from California, *Douglas*. All the California species are included under *Elymus sitanion* Schult. by Thurber (Wats. Bot. Cal. 2: 327. 1880) and Davy (Jepson, Fl. W. Mid. Cal. 81. 1901).

3. **S. breviaristatum** J. G. Smith. Culms 1 to 1½ feet high; sheaths glabrous, slightly scabrous, the lower papery; blades long, involute; spike 1 to 2 inches long; glumes split as in S. jubatum, the awns of glumes and lemmas 7 to 10 lines long, spreading or recurved.

A little-known species (or possibly a form of S. jubatum) represented by only two specimens: Madison, *Heller* 5577; Panamint Mts., *Coville & Funston* 833.

Ref.—SITANION BREVIARISTATUM J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 12. 1899, type *Coville & Funston* 833.

4. **S. minus** J. G. Smith. Culms low, much tufted, mostly 4 to 8 inches high; sheaths smooth or somewhat scabrous, or puberulent, the old ones usually numerous at the base of the culms; blades smooth or puberulent; spike 1 to 2 inches long; glumes, or at least some of them, bifid from near the base; lemmas smooth; awns about an inch long, spreading.

Dry hills and rocky slopes, California to Washington, mostly at altitudes above 5000 feet.

Locs.—Yreka, *Butler* 1278 (differs in being pilose, thus referable to *S. ciliatum* Elmer of Washington, if that prove to be a distinct species); Mt. Shasta, *Brown* 372; Last Chance, *Doten* 46; Ebbetts Pass, *Brewer* 2072; Mt. Lyell, *Hitchcock* 3305; Mt. Pinos, *Hall* 6551; Griffin, *Elmer* 3990; Mt. San Antonio, *Abrams* 1932, 2700; San Gorgonio Peak, *Hall* 7633; San Jacinto Peak, *Reed* 2497; Tahquitz Peak, *Reed* 2530.

Refs.—SITANION MINUS J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 12. 1899, type from Jacumba, San Diego Co., *Schoenfeldt* 3277. *S. rigidum* J. G. Smith, op. cit. 13.

5. **S. glabrum** J. G. Smith. Culms 6 to 15 inches high; sheaths smooth or somewhat scabrous; blades soon involute, glabrous or scabrous below, puberulent above; spike 1 to 2 inches long, dense; glumes, or some of them, bifid to near the base; lemmas smooth, the awns slender, 1 to 2 inches long.

Dry, mostly alkaline soil, Mt. Pinos north to Washington, east to Wyoming.

Locs.—Grenada, *Heller* 8071; Southern Belle Mine, Mono Co., *Heller* 8329; Hunter's Ranch Mts., Inyo Co., *Hall & Chandler* 7146; Argus Mts., *Purpus* 5381; San Francisco, *Brewer* 1553; Antelope Valley, *Davy* 2313; Cuyama White Hills, *Eastwood;* Mt. Pinos, *Hall* 6636.

Ref.—SITANION GLABRUM J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 14. 1899, type from Coso Mts., *Coville & Funston* 914.

6. **S. californicum** J. G. Smith. Culms 1 to 2 feet high; sheaths glabrous or scabrous, sometimes puberulent; blades flat or becoming involute, glabrous beneath, scabrous above, sometimes puberulent; spike 2 to 3 inches long, rather loose and open; glumes entire, long-awned; lemmas smooth, 4 to 5 lines long; awns 1½ to 2½ inches long.

Gravelly or rocky slopes and dry open woods, mostly at rather high altitudes, from the southern boundary, northward through the San Jacinto and San Bernardino mountains and the Sierra Nevada to Washington; also in the region of Mt. Shasta.

Refs.—SITANION CALIFORNICUM J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 13. 1899, type from San Bernardino Mts., *Parish* 3295; Abrams, Fl. Los Ang. 64. 1904.

71. HYSTRIX Moench.

Spikelets 2 to 4-flowered, nearly sessile, 1 to 3 together at each joint of the continuous rachis, and facing it as in Elymus, widely divergent at maturity. Glumes reduced to short or minute awns, the first usually obsolete, both often wanting in the upper spikelets. Lemmas convex, rigid, tapering into long awns. Perennials, with flat blades and loosely-flowered bristly spikes.—Species 4, temperate regions, 2 in North America, 1 in Siberia, 1 in New Zealand. (Greek hustrix, a porcupine.)

1. **H californica** Kuntze. Culms stout, 3½ to 6 feet high; sheaths hispid or the upper smooth; blades flat, as much as ¾ inch wide, scabrous; spike stout, dense and somewhat nodding above, more or less interrupted below, 5 to 10 inches long; spikelets mostly in pairs, 1 to 3-flowered, on short callus-like pedicels; glumes wanting; lemmas 6 to 7 lines long, 5-nerved above, the nerves, especially the marginal, ciliate-hispid with short stiff hairs; awn stout, straight, rough, about 10 lines long.

Woods and shaded banks, near the coast, Marin to Santa Cruz cos.

Locs.—Olema, *Davy* 4306, 4318; near San Francisco, *Kellogg & Harford* 1107; San Gregorio redwoods, *Kellogg & Brannan;* Crystal Lake Springs, *Elmer* 4700; Santa Cruz, *Anderson.*

Refs.—HYSTRIX CALIFORNICA Kuntze, Rev. Gen. Pl. 778. 1891. *Gymnostichum californicum* Boland.; Thurb. in Wats. Bot. Cal. 2: 327. 1880, type from San Francisco, *Bolander.* *Asperella californica* Beal, Grasses N. Am. 2: 657. 1896; Davy in Jepson, Fl. W. Mid. Cal. 81. 1901.

CYPERACEAE. SEDGE FAMILY.

Grass-like or rush-like herbs with fibrous roots, many species perennial by long rootstocks. Stems solid (rarely hollow), usually triangular or terete, commonly scape-like with mostly basal leaves. Leaves alternate, narrow, with closed sheaths, often 3-ranked. Flowers one in the axil of each bract (scale),

Jepson, Fl. Cal. vol. 1 (Gramineae by Hitchcock, pp. 101-189). Apr. 30, 1912.

borne in spikelets or spikes which are arranged in clusters, racemes, panicles or umbels. Perianth none or represented by usually 4 to 6 bristles. Stamens 1 to 3. Pistil 1; ovary 1-celled with 1 ovule, the single style 2 or 3-cleft. Fruit a lenticular or 3-angled achene. Embryo minute in mealy endosperm.—About 65 genera and 3000 species, widely distributed over the earth, chiefly as marsh plants.

Bibliog.—Clarke, C. B., Indian Species of Cyperus (Jour. Linn. Soc. vol. 21, pp. 1-202,—1884). Britton, N. L., Preliminary List N. Am. Species of Cyperus (Bull. Torr. Club, vol. 13, pp. 205-16,—1886); Genus Eleocharis in N. Am. (Jour. N. Y. Mic. Soc. vol. 5, pp. 95-111,—1889); List of Species of Scirpus and Rhyncospora in N. Am. (Trans. N. Y. Acad. Sci. vol. 11, pp. 74-93,—1892). Bailey, L. H., Preliminary Synopsis N. Am. Carices (Proc. Am. Acad. vol. 22, pp. 59-157,—1886). Parish, S. B., Preliminary Synopsis of Southern California Cyperaceae (a series of papers in Bull. S. Cal. Acad. Sci. vols. 3-5. 1904-1906). Clarke, C. B., New Genera and Species of Cyperaceae (Kew. Bull. Add. Ser. 8,—1908). Kükenthal, Georg, Caricoideae (Engler, Pflzr. teil 4, abt. 20,—1909).

Flowers all perfect; spikelets many-flowered, with 1 or 2 of the lower scales empty.—SCIRPEAE.

Spikelets flattened, the scales in 2 opposite ranks; inflorescence involucrate.....1. CYPERUS.

Spikelets cylindrical, the scales imbricated around the axis in several rows.

Style enlarged or bulbous at base.

Bulbous base of style persistent on the achene; perianth bristles generally present; spikelet solitary, terminating the naked stem, the leaves at base reduced to sheaths..2. ELEOCHARIS.

Bulbous base of style deciduous, not persistent on achene; perianth bristles none; spikelets umbellate or capitate, the stems leafy at base........3. FIMBRISTYLIS.

Style not enlarged at base; perianth bristles usually present.

Scales not enclosing a bractlet; perennials.

Perianth bristles (1 to 8) barbed or none; stamens mostly 3; spikelets solitary or clustered or in a compound umbel; stem often leafy at base and inflorescence involucrate ....4. SCIRPUS.

Perianth bristles numerous, naked, long-exserted and silky in fruit; stamens 1 to 3; spikelets few, otherwise as in Scirpus.......................5. ERIOPHORUM.

Scales enclosing a minute bractlet; annuals.........................6. HEMICARPHA.

Flowers of 2 kinds, perfect and staminate; spikelets few (1 or 2, sometimes to 6)-flowered, with 3 to several of the lower scales empty.—RHYNCOSPOREAE.

Scales 2-ranked; style wholly deciduous.................................7. SCHOENUS.

Scales spirally imbricated.

Style wholly deciduous; perianth bristles none..........................8. CLADIUM.

Style or its base persistent as a tubercle or beak on the achene; perianth bristles commonly present ....9. RHYNCOSPORA.

Flowers monoecious or sometimes dioecious; spikes unisexual or androgynous; achene enclosed in a sac (perigynium) or spathe.—CARICEAE.............................10. CAREX.

1. CYPERUS L. GALINGALE.

Annuals or perennials. Stems triangular or terete, never branched, leafy at base. Inflorescence subtended by a conspicuous leafy involucre, umbellate with unequal rays and a sessile central spike, or capitate. Flowers in flattened or subterete spikelets, the spikelets in capitate clusters or arranged in spikes borne on the rays. Scales concave, more or less carinate, 2-ranked. Perianth none.—Species 544, all continents but chiefly in the warmer parts of the earth. (Greek Kupeiros, the ancient name.)

Style 2-cleft; achene lenticular or at least not triangular; spikelets flat; scales falling from the rachis; rachis not winged.

Spikelets in a close terminal cluster; scales sharply carinate; achene lenticular.

Achene oblong; stamens 2; scales obtuse, 1 line long............1. *C. melanostachyus.*

Achene ovoid; stamens 3; scales acute, 2 lines long.................2. *C. bromoides.*

Spikelets in an apparently lateral cluster; stamens 3; scales scarcely carinate; achene plano-convex ....3. *C. laevigatus.*

Style 3-cleft; achene 3 angled.

Spikelets flattened; scales falling away from the rachis which is persistent on the spike.

Rachis naked or nearly so, the scales not decurrent upon it; stamen 1.

Scales not toothed on back; low or dwarf annuals.

Scales 7 to 9-nerved, with strongly recurved setaceous tips.........4. *C. aristatus.*

Scales obscurely 3-nerved, with short recurved tips.............5. *C. acuminatus.*

Scales minutely toothed on back at apex, obtuse or merely acute, without recurved tips; tall perennial...6. *C. virens.*

Rachis with the scales decurrent upon it as narrow scarious wings; stamens 3.

Wings of the rachis soon separating to the base; annual.

Wings persistent on the rachis............................7. *C. erythrorhizos.*

Wings readily deciduous...................................8. *C. sphacelatus.*

Wings of the rachis persistent; perennial by means of tuber-bearing rootstocks........ 9. *C. esculentus.*

Spikelets not so strongly flattened, deciduous from (but the 2 lowest scales persistent on) the spike; wings broad, scarious, wholly adnate to rachis; stamens 3.

Perennials with basal tuber-like corms; spikelets falling whole; wings not enclosing achenes ....10. *C. strigosus.*

Annuals; spikelets breaking up into 1-fruited joints; wings very broad, enclosing achenes.

Spikes oblong, compact ....11. *C. speciosus.*

Spikes short, loose and spreading...............................12. *C. ferax.*

1. **C. melanostachyus** H. B. K. Annual; stems very slender, triangular, ¾ to 1 foot high; leaves elongate-tapering, 1 line wide or less; involucral bracts 2 or 3, foliaceous, narrowly linear, ½ to 3½ inches long; spikelets oblong, 3 to 6 lines long, in a small capitate cluster; scales chestnut-brown, keeled, 3-nerved on back, very obtuse, 1 line long; achene lenticular, sharply beaked.

Jackson, *Hansen* 644; lower Sacramento River, *Jepson;* San Francisco, *Bolander* 2330; Los Angeles River, *Braunton* 566; San Bernardino, *Parish* 3811. Mexico south to Argentina.

Refs.—CYPERUS MELANOSTACHYUS H. B. K. Nov. Gen. & Sp. 1:207 (1815). *C. diandrus* Torr. var. *castaneus* Torr.; Wats. Bot. Cal. 2:214 (1880); var. *capitatus* Britton, Bull. Torr. Club, 13:205 (1886). *Pycreus melanostachyus* C. B. Clarke, Contrib. U. S. Nat. Herb. 10:446 (1908).

2. **C. bromoides** Link. Annual; stems slender, 1 to 1⅔ feet high, exceeding the few rough-margined leaves; spikelets 4 to 9 lines long; involucral leaves 2 to 4, the longest 4 to 5½ inches long; scales acute, yellow-brown, about 2 lines long, the keel 3-nerved and the margins scarious; achene ovoid, black, ⅓ as long as scale.

Los Angeles Co. acc. Parish; Mexico and tropical regions of the Americas.

Refs.—CYPERUS BROMOIDES Link, Jahrb. Berl. 1^3: 85 (1818); Parish, Bull. S. Cal. Acad. Sci. 3:49 (1904). *C. uniloides* R. Br. var. *bromoides* Clarke, Jour. Linn. Soc. 21:60 (1884).

3. **C. laevigatus** L. Perennial, the stems arising at intervals from a wiry rootstock; stems subterete, slender, 3 to 10 inches high, hardly surpassing the erect filiform leaves; spikelets 2 to 5, 2 to 4 lines long, in a sessile apparently lateral cluster; involucre of usually 2 bracts, one long (1 to 2 inches) and erect, in continuation of stem, the other short (3 or 4 lines long) or wanting; rachis deeply pitted transversely; scales orbicular, 3-nerved in middle, a brown blotch on each side, closely imbricated, ¾ line long; achene oblong, gray, ½ as long as scale.

Along streams in wet sand: Big Morongo, Colorado Desert, acc. *Parish;* San Bernardino, *Parish;* Pasadena, *McClatchie;* Los Angeles, *Brewer.* South into Mexico. All continents.

Refs.—CYPERUS LAEVIGATUS L. Mant. 2:179 (1771); Wats. Bot. Cal. 2:214 (1880).

4. **C. aristatus** Rottb. Dwarf annual; stems ½ to 6 inches high, barely exceeding the leaves; leaves flat, ½ line or less wide; involucral bracts folia-

ceous, ½ to 2 inches long; spikelets linear-oblong, 1½ to 3 lines long, in a dense compound head or in close clusters on 2 or 3 short (¼ to 1 inch long) rays; rachis not winged; scales 7 to 9-nerved, with strongly recurved setaceous tips, chestnut-brown or greenish, ⅔ to 1 line long; achene 3-angled.

San Jacinto Mts., *Hall* 2663; San Bernardino Valley, *Parish;* Mohave River, acc. *Parish;* Tehipite Valley, 4000 feet alt., *Hall & Chandler* 510; Yosemite, *Bolander* 6223; Hetch-Hetchy, *Jepson* 3479; Jackson, *Hansen* 643; Chico, *Greene, Copeland* 3489; north to British Columbia and east to the Atlantic States. South America, Africa, Asia, Australia.

Refs.—CYPERUS ARISTATUS Rottb. Desc. Nov. Pl. 22 (1773). *C. inflexus* Muhl. Gram. 16 (1817).

5. **C. acuminatus** Torr. & Hook. Annual; stems slender, tufted, 5 to 12 inches high; leaves commonly less than 1 line wide; bracts of the involucre 2 or 3, much elongated; spikelets 3 or 4 lines long, capitate on the rays or the whole inflorescence congested and head-like; scales oblong, obscurely 3-nerved, with a short recurved tip; achene 3-angled, about ½ as long as scale.

Round Meadow, Giant Forest, *Grant* 2436; Tulare Co., *Congdon*, acc. Britton; Oregon, Washington; Arizona east to Louisiana and Illinois.

Refs.—CYPERUS ACUMINATUS Torr. & Hook. Ann. Lyc. N. Y. 3:435 (1836); Britton, Bull. Torr. Club, 13:209 (1886).

6. **C. virens** Michx. Perennial; stems triangular, 1 to 3 feet high; involucral bracts 4 to 6, very long and leafy, broad and strongly keeled; umbel compound, or the spikes capitate on the rays, or the whole often much reduced and subcapitate; spikelets numerous, many-flowered, long-oblong, 4 to 8 lines long; scales concave-carinate, serrulate on back at apex, 1 line long; achene 3-angled.

Mt. Shasta, *Grant;* Chico, *Copeland* 3490; Ione, *Braunton* 1012; Grand Island, *Jepson;* Healdsburg, *King;* Berkeley, *Walker* 434; San Francisco, *Bioletti;* Los Gatos, *Heller* 7487; Kings River, *Lemmon;* San Bernardino, acc. *Parish.* East to North Carolina and south to Central America.

Refs.—CYPERUS VIRENS Michx. Fl. Bor. Am. 1:28 (1803); Wats. Bot. Cal. 2:214 (1880). *C. serrulatus* Wats. Proc. Am. Acad. 17:382 (1882), type loc. Placer County, *George Vasey;* Jepson, Fl. W. Mid. Cal. 84 (1901).

7. **C. erythrorhizos** Muhl. Annual; stems 1 to 1½ feet high, stout, triangular; leaves flat or conduplicate, 6 to 14 inches long, 2 to 3 lines wide; involucral bracts 6 to 8, foliaceous, 4 to 12 inches long; rays 1½ inches long or less, bearing umbels of spikes which are ½ to 1 inch long; bracts of involucels shorter, foliaceous; spikelets usually 2 to 3 lines long, narrowly linear, somewhat crowded, horizontally spreading, nearly flat, bright chestnut-color; rachis clothed with the persistent wings of the scales; scales elliptical, obtuse, mucronulate, ⅔ line long; keel smooth; achene 3-angled.

Clear Lake, *Bolander* 2631; Sacramento and San Joaquin valleys along the main rivers. East to the Atlantic States.

Refs.—CYPERUS ERYTHRORHIZOS Muhl. Gram. 20 (1817); Wats. Bot. Cal. 2:215 (1880); Jepson, Fl. W. Mid. Cal. 85 (1901).

8. **C. sphacelatus** Rottb. Annual, similar in habit to the next; stems tufted, slender, 4 to 10 inches high; leaves 1 to 2½ lines wide, shorter than the stems; spikelets numerous, densely short-spicate, linear, 1 line wide; rachis at length wingless, the narrow wings early deciduous; scales oblong-lanceolate, purple-green, several nerved, 1 line long; achenes nearly black, 3-angled, ½ as long as scale.

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Southern California. Mexico, tropical America.

Locs.—San Bernardino Mts., acc. Parish; Rock Creek, acc. Parish; Elsinore Lake, acc. Parish.

Refs.—CYPERUS SPHACELATUS Rottb. Desc. & Ic. 26 (1773). *C. parishii* Britton; Parish, Bull. S. Cal. Acad. 3:52, pl. 3 (1904), type from San Bernardino, *Parish* 3816.

9. **C. esculentus** L. CHUFA. NUT-GRASS. Perennial, with slender rootstocks bearing small globose tubers; stems triangular, ½ to 1 foot high; spikes in an umbel subtended by foliaceous bracts 7 inches long or less; spikelets chestnut-brown, linear, 4 to 8 inches long, the joints of the rachis with a narrow wing on each side subtending the achene; scales ovate, obtuse, 3 or 4 nerves each side of the keel, 1½ lines long; achene black, 3-angled.

Infrequent but widely scattered in California. East to the Atlantic. All continents.

Locs.—Los Angeles, *Braunton* 630, 671, 723; Colton, *Parish* 2227; Yosemite, *Jepson* 8366 (spikelets subcapitate); Ione, *Braunton* 1175; Cloverdale, *Brush*. Var. **heermannii** Britton; spikes clustered at summit of rays and involucellate; spikelets sometimes bracteate.—Southern Sierra Nevada (Bot. Cal. 2:215).

Refs.—CYPERUS ESCULENTUS L. Sp. Pl. 45 (1753), type loc. Montpellier, France; Clarke, Jour. Linn. Soc. 21:178 (1884); McAtee, U. S. D. A. Bull. 58:8, figs. 8–10 (1914). Var. HEERMANNII Britton, Bull. Torr. Club, 13:211 (1886). *C. phymatodes* Muhl. Gram. 23 (1817); Wats. Bot. Cal. 2:215 (1880). Var. *heermannii* Wats. l.c. *C. heermannii* Buckley, Proc. Phila. Acad. 1862:10 (1863), type from Kern River, *Heermann*.

10. **C. strigosus** L. Perennial; stems 1 to 1½ feet high; spikes dense, ½ to 1 inch long, on rays 5 inches long or less, in a more or less compound umbel, the foliaceous involucral bracts 2 to 10 inches long; spikes with the lowest scales persistent on rachis after fall of spikelet from spike; spikelets linear, 6 to 9-flowered, 4 to 9 lines long, the slender joints with a scarious wing embracing one margin of the achene; scales slender ovate, 2 (or 3) callous striae on each side the keel, 2 lines long; achene oblong, 3-angled.

Sierra Nevada. Texas to Florida and Maine.

Loc.—Mormon Bar, Mariposa Co., *Congdon*.

Refs.—CYPERUS STRIGOSUS L. Sp. Pl. 47 (1753), Jamaica, Virginia. *C. stenolepis* Wats. Bot. Cal. 2:215 (1880), not Torr.

11. **C. speciosus** Vahl. Annual; stem stout, 1 foot high; umbel compound or simple, subtended by several foliaceous bracts 5 to 13 inches long; rays 1 to 2 inches long; spikelets linear-lanceolate, 3 to 6 lines long, spreading at mostly right angles to the spike, the very short joints of its rachis winged with very broad scarious margins which enclose the 3-angled achene; scales ovate, overlapping, with a round green back and scarious rusty red sides, 1½ lines long.

Upper San Joaquin Valley; Southern California. East to the Atlantic. Tropical regions.

Locs.—Visalia, *Congdon*; San Bernardino, *Parish* 3819, 6432; Los Angeles River, *Braunton* 578.

Refs.—CYPERUS SPECIOSUS Vahl, Enum. 2:364 (1806), type loc. Va.; Parish, Bull. S. Cal. Acad. 3:54 (1904). *C. michauxianus* Schult. Mant. 2:123 (1824); Wats. Bot. Cal. 2:215 (1880).

12. **C. ferax** Rich. Annual, closely related to C. speciosus, but leaves shorter, broader and with smoother margins; scales more rigid; spikelets stouter.

Common in Southern California. East to Missouri; widely distributed in Tropical America.

Locs.—San Bernardino, acc. *Parish*; Elsinore, acc. *Parish*.

Refs.—CYPERUS FERAX Rich. Act. Soc. Hist. Nat. Paris 1:106 (1792). *C. longispicatus* Norton, Trans. Acad. St. Louis 12:37, pl. 5 (1902), type loc. San Antonio, Tex., *B. F. Bush* 1248; Parish, Bull. S. Cal. Acad. 3:54 (1904).

2. ELEOCHARIS R. Br. Spike-Rush.

Annuals or chiefly perennials. Stems tufted, simple, terminating in a solitary spikelet not subtended by an involucre. Leaves reduced to sheaths or the lowest rarely blade-bearing. Spikelets several to many-flowered. Scales concave. Stamens 2 or 3. Perianth-bristles 3 to 9, commonly retrorsely barbed. Style 3-cleft and achene 3-angled, or 2-cleft and achene lenticular; base of the style enlarged and persistent as a tubercle on the summit of the achene.—Species 127, widely distributed from the arctic to antarctic regions. (Greek elos, marsh, and charis, delight.)

Bibliog.—Fernald, M. L., Eleocharis ovata and its N. Am. Allies (Proc. Am. Acad. 34:485-497,—1899).

Style mostly 2-cleft; achene lenticular or biconvex.

Achene jet-black; tubercle depressed; annual .... 1. *E. capitata.*

Achene light-brown.

Perennial; tubercle conical, less than half as broad as the body of the achene; spikelet lanceolate .... 2. *E. palustris.*

Annual; tubercle thin, deltoid, as broad or nearly as broad as the achene; spikelet ovate.

Bristles often nearly twice as long as the achene .... 3. *E. obtusa.*

Bristles $\frac{1}{4}$ to $\frac{1}{2}$ as long as the achene .... 4. *E. monticola.*

Style 3-cleft; achene turgid or 3-angled; perennial.

Tubercle reduced to a mere scar or very obscure .... 5. *E. bolanderi.*

Tubercle well-developed and more or less prominent.

Achene with several longitudinal ridges connected by a transverse lattice-work; spikelet flattened .... 6. *E. acicularis.*

Achene smooth.

Stems erect or nearly so, not rooting at tip; tubercle constricted at base or at least sharply defined from the achene.

Spikelet lanceolate; scales acute .... 7. *E. parishii.*

Spikelet oblong; scales obtuse .... 8. *E. montana.*

Stems or some of them bending over and rooting at tip; tubercle subulate or narrowly pyramidal, continuous with the achene .... 9. *E. rostellata.*

1. **E. capitata** R. Br. Stems erect, tufted, 7 to 8 inches high; spikelet ovate, $1\frac{1}{4}$ to 2 lines long; bristles 6 (or 7), about as long as the achene; stamens 2 or 3; achene black and shining, lenticular; tubercle white, thin and a little like a skull-cap.

Wet sandy soil, Southern California. Eastern United States, Asia, Africa, Australia.

Locs.—Warm Creek, San Bernardino, *Parish;* Palm Sprs., acc. *Parish;* Thousand Palms Cañon, Riverside Co., *Jepson* 6043; Dos Palmas, *Hall* 5984.

Ref.—Eleocharis capitata R. Br. Prodr. Fl. Nov. Holl. 1:225 (1810), types from Virginia and the Caribbees.

E. atropurpurea Kunth, Enum. Pl. 2:151 (1837). *Scirpus atropurpureus* Retz. Obs. 5:14 (1789), type loc. India. Near E. capitata; scales minute; bristles 2 to 4, white, or wanting; achene jet black, lenticular; tubercle conic, minute, depressed.—Visalia (acc. Coville, Contrib. U. S. Nat. Herb. 4:211). Widely distributed, occuring in the eastern United States and in all continents.

2. **E. palustris** R. & S. Common Spike-rush. Wire-grass. (Fig. 14.) Stems $\frac{1}{2}$ to 2 feet high, stoutish, mostly terete, sheathed at the base, leafless, creeping, stoloniferous; sheaths sub-truncate; rootstock stout; spikelet many-flowered, 6 to 14 lines long; bracts ovate-oblong to oblong-lanceolate; scales ovate-oblong, purplish brown with scarious margin; bristles 3, rather shorter than the achene; style 2-cleft; achene obovoid, biconvex; tubercle deltoid, constricted at the point of junction.

Ponds, marshes and shallow slow-moving creeks, at low altitudes in California. North to British Columbia and east to the Atlantic. Europe, Asia.

Locs.—Sierra Valley, *Jepson* 8044; Honey Lake Valley, *Davy* 3288; Jess Valley, Modoc Co., *Jepson* 7988; Klamath Hot Sprs., *Goldsmith* 26; Yreka, *Butler* 1410; Sisson, *Jepson* 58a; Eureka, *Tracy* 2973; Chico, *Copeland* 3182; Los Guilicos Valley, *Bioletti;* San Francisco, *Davy* 4012; Lake San Andreas, San Mateo Co., *Davy* 764; Irvington, *Jepson;* Ione, *Braunton* 1058; Oakdale, *Jepson* 8337; Victor, *Parish* 10562; Palo Verde Valley, *Hall* 5919; San Bernardino, *Parish;* Elsinore, *McClatchie* 23.

Refs.—ELEOCHARIS PALUSTRIS R. & S. Syst. Veg. 2:151 (1817); Davy in Jepson, Fl. W. Mid. Cal. 85 (1901). *Scirpus palustris* L. Sp. Pl. 47 (1753), type European. Var. GLAUCESCENS Gray, Man. 558 (1848), type North American; tubercle narrower, sometimes half as long as the achene.—Southern California (San Jacinto Mts. and San Bernardino Valley), acc. Parish, Bull. S. Cal. Acad. 3:68 (1904).

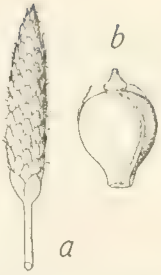

Fig. 14. ELEOCHARIS PALUSTRIS R. & S. *a*, spikelet, × 1; *b*, achene, × 8.

3. **E. obtusa** Schult. (Fig. 15.) Stems tufted, numerous, erect, nearly terete, striate, 7 to 10 (16) inches high; annual with fibrous roots; spikes oblong-ovate to broadly ovate, 2 to 4 lines long; scales ovate to sub-orbicular, rounded at apex; bristles 6 to 9, mostly longer, sometimes nearly twice longer than the achene; achene smooth, shining, obovoid with a narrow base, somewhat flattened or biconvex with cord-like or thickened margins, the broad summit bearing a very thin deltoid acutish tubercle, in outline something like a cocked hat.

Moist places or in shallow water, Sierra Nevada and North Coast Ranges. North to Oregon. Atlantic States.

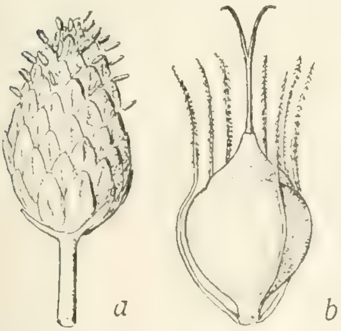

Fig. 15. ELEOCHARIS OBTUSA Schult. *a*, spikelet, × 4; *b*, achene and bristles, × 13.

Locs.—Scott Valley, Lake Co., *Tracy* 2379; near Willow Creek, Trinity River, *Tracy* 3401; Oro Fino, Siskiyou Co., *Butler* 7, 1855; Yosemite Valley, *Jepson* 8369.

Refs.—ELEOCHARIS OBTUSA Schult. Mant. 2:89 (1824). *Scirpus obtusus* Willd. Enum. Hort. Berol. 76 (1809), type North American.

4. **E. monticola** Fern. Resembling E. obtusa; stems 4 to 10 inches high; spikes ovate-lanceolate, 3 to 4½ lines long; scales acutish, more spreading.

Northern Sierra Nevada, and north to Oregon and Idaho.

Ref.—ELEOCHARIS MONTICOLA Fern. Proc. Am. Acad. 15:496 (1899), based on spms. from the northern Sierra Nevada (*Lemmon* 485; *Mary E. P. Ames*, Plumas Co.), and Ore. (Multnomah Co., *Howell* 408).

5. **E. bolanderi** Gray. Stems tufted, 8 to 9 inches high, arising from rootstocks; spikes dark-colored, narrow-ovate, 2½ to 3 lines long; bristles 3 or 4, about ¼ to ½ (or ⅗) as long as the achene; achene obovoid, triangular with cord-like ridges at the angles; tubercle reduced to a flatish scar, very short and broad or somewhat obscure.

Central Sierra Nevada, 6000 to 7000 feet.

Locs.—Mariposa Grove, *Bolander* 4869; Hogan Mt., Mariposa Co., *Congdon;* Pea Ridge road, Mariposa Co., *Congdon.*

Ref.—ELEOCHARIS BOLANDERI Gray, Proc. Am. Acad. 7:392 (1868), type loc. Wawona (Clark's), *Bolander.*

6. **E. acicularis** R. & S. SLENDER SPIKE-RUSH. (Fig. 16.) Stems tufted, ½ to 1½ (or 8) inches high, filiform or setaceous; rootstock very slender, creeping; spikelets a little flattened, 1 to 3 lines long, few-flowered; achene obovoid-oblong, ½ line long, obscurely triangular, with 9 or 10 longitudinal ribs connected by fine transverse lines; tubercle broad, short and blunt.

Moist places throughout California, but not reported from the deserts. All continents.

Locs.—Cuyamaca, *T. Brandegee;* Mt. San Jacinto, *Hall* 2232; San Bernardino, *Parish* 2143; Yosemite, *Jepson* 8365, 8371; Confidence, Tuolumne Co., *Jepson* 7707; Calaveras Grove, *Hillebrand* 2332; upper Fall River Valley, *Jepson* 5753; Klamath Hot Sprs., *Goldsmith* 22; Forestdale, Modoc Co., *Baker & Nutting;* Oro Fino, Siskiyou Co., *Butler* 866.

Refs.—ELEOCHARIS ACICULARIS R. & S. Syst. Veg. 2:154 (1817). *Scirpus acicularis* L. Sp. Pl. 48 (1753), type European. *E. acicularis* var. *radicans* Britton, Jour. N. Y. Mic. Soc. 5:105 (1889).

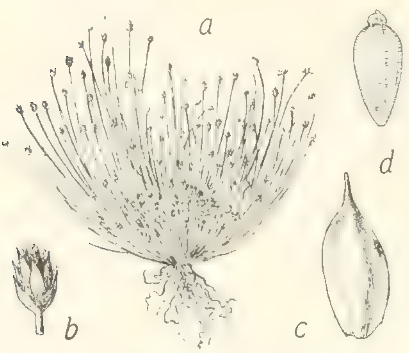

Fig. 16. ELEOCHARIS ACICULARIS R. & S. *a*, entire plant, × 1; *b*, spikelet, × 5; *c*, bract, × 18; *d*, achene, × 18.

7. **E. parishii** Britton. Stems 4 to 7 inches high, strongly striated, arising from a slender rootstock; spikes slender-lanceolate, 3 to 7 lines long, dark chestnut-color; bristles 6 (or 7), ciliate, exceeding or sometimes rather shorter than the achene; achene nearly plane on one side, convex and somewhat keeled on the other; tubercle narrow, short, somewhat like a fool's cap.

Valley and mountain marshes throughout California.

Locs.—Palm Cañon, e. base Mt. San Jacinto, *Parish* 6145; San Antonio Mts., *Hall* 1517; Mohave, *Parish* 9796; Seymour Mdws., Mt. Pinos, *Hall* 6625; San Emigdio, Potreros, *Hall* 6370; Owens Lake, *Hall & Chandler* 7325; Ibex Spr., Inyo Co., *Parish* 10025; San Joaquin River Bridge, *K. Brandegee;* Chico, *Copeland* 3280; Castle Rock, Sacramento River, *Goldsmith;* Hornbrook, Siskiyou Co., *Copeland* 3556.

Refs.—ELEOCHARIS PARISHII Britton, Jour. N. Y. Mic. Soc. 5:110 (1889), type loc. Palm Sprs. (Agua Caliente), *Parish* 1569. *E. disciformis* Parish, Bull. S. Cal. Acad. 3:81 (1904), type loc. e. base Mt. San Jacinto, *Hall* 2013 (in isotype material of this the achene shape, the tubercle and bristles are as in E. parishii; it is, however, said to be annual).

8. **E. montana** R. & S. Stems 10 to 14 inches high from stoutish rootstocks; spikelets narrowly oblong, 2½ to 5 lines long; scales straw-color or light-brown; bristles 5 or 6, exceeding or a little shorter than the achene; achene obovoid, flattish on one side, strongly convex on the other; tubercle conical, broadened at base.

Southern California, north in the Coast Ranges and Sierra Nevada. East to Colorado and New Mexico, south to South America.

Locs.—La Mesa, *Jepson* 6684; Witch Creek, San Diego Co., acc. *Parish;* Los Angeles, acc. *Parish;* San Bernardino Valley, *Jepson* 5595; Victorville, *Parish* 10563; Soulsbyville, Tuolumne Co., *Jepson* 7686; Hopland, *Jepson* 7625.

Refs.—ELEOCHARIS MONTANA R. & S. Syst. Veg. 2:153 (1817), type loc. Quindiu, Columbia. *E. arenicola* Torr. Jour. Bost. Soc. Nat. Hist. 5:237 (1845), type loc. Galveston Isl., Tex., *Lindheimer.*

9. **E. rostellata** Torr. WALKING-SEDGE. Stems from a short caudex, 1 to 2½ feet high, the sterile ones bending over and rooting at the apex; spikelet oblong, 3 to 5-flowered; scales light-brown or straw-color; bristles 6, exceeding the achene; achene obovoid, obtusely triangular; tubercle stoutly subulate or narrowly pyramidal, half or nearly half as long as the achene.

Marshy meadows: cismontane Southern California and east and northeast through the Colorado and Mojave deserts. Mostly throughout North America.

Locs.—San Bernardino, acc. Parish; Owens Lake, *Jepson* 5117; Death Valley (Contrib. U. S. Nat. Herb. 4:211). Var. **congdonii** Jepson n. var. Bristles equaling the achene; tubercle barely ⅓ as long as the achene.—(Setae achenio aequales; tuberculum vix longum triente quam achenium).—San Francisco, *Congdon* (type).

Refs.—ELEOCHARIS ROSTELLATA Torr. Fl. N. Y. 2:347 (1843), based on material from New York and South Carolina. Var. *occidentalis* Wats. Bot. Cal. 2:222 (1880), based on spms. from Ft. Tejon, *Horn,* and San Bernardino Co., *Parry & Lemmon* 398.

3. **FIMBRISTYLIS** Vahl.

Annuals or perennials. Stems leafy below. Spikelets umbellate or capitate, terete, subtended by a 1 to many-leaved involucre. Scales spirally imbricated all around, mostly deciduous. Perianth bristles none. Stamens 1 to 3. Style 2 to 3-cleft, its base swollen, and commonly tuberculate, the whole falling away from the achene at maturity. Achene lenticular or 3-angled.—Species 131, all continents. (Latin fimbri, fringe, and stylus, style.)

Achene triangular; tubercle more or less persistent; style glabrous; annual ....1. *F. capillaris.*
Achene flattened or biconvex; tubercle deciduous.
  Spikelets clustered; style glabrous, at least below; annual ....2. *F. vahlii.*
  Spikelets umbellate, solitary on the rays or in the forks; style ciliate; perennial.
3. *F. thermalis.*

1. **F. capillaris** Gray. Stems tufted, somewhat bristle-like, 2 to 7 inches high, much exceeding the filiform leaves, and bearing 1 to 3 spikelets, when 3 the stem shortly forked at apex and bearing 1 spikelet in the fork; spikelets narrowly ovate, $1\frac{1}{2}$ to $2\frac{1}{2}$ lines long; involucral bract lanceolate-setaceous; "stamens 2"; achene obovoid, triangular, lightly wrinkled transversely, the angles somewhat thickened; tubercle small, deltoid, more or less persistent.

Sierra Nevada.

Loc.—Near the Royal Arches, Yosemite Valley, *Jepson* 8410.

Refs.—FIMBRISTYLIS CAPILLARIS Gray, Man. 530 (1848). *Scirpus capillaris* L. Sp. Pl. 49 (1753), cited as occurring in Virginia, Ethiopia & Ceylon. *Stenophyllus capillaris* Britton, Bull. Torr. Club, 21:30 (1894).

F. MILIACEA Vahl, Enum. Pl. 2:287 (1806); umbel diffusely compound; spikelets subglobose, about 1 line long; achene whitish, acutely triangular, muricate-tuberculate.—"Near San Francisco" (Bot. Cal. 2:223) in 1866, but not since found.

2. **F. vahlii** Link. Stems slender, densely tufted, 1 to 4 inches high, longer than or equaling the filiform leaves; spikelets in clusters, subtended by filiform elongated upright bracts which exceed the cluster 4 to 6 times; achene minute, transversely reticulate.

Very local in California: North Coast Ranges; upper San Joaquin Valley; lower Colorado River. Southeastern United States and South America.

Locs.—Clear Lake (Bot. Cal. 2:224); Visalia (acc. Coville, Contrib. U. S. Nat. Herb. 4:212); Ft. Yuma, *Parish* 8375, 8495.

Refs.—FIMBRISTYLIS VAHLII Link, Hort. Berol. 1:287 (1827). *Scirpus vahlii* Lam. Tab. Encycl. 1:139 (1791), type loc. Spain. *F. apus* appears to be merely a form in which the tubercle is reduced or obsolete and so we quote: *F. apus* Wats. Bot. Cal. 2:224 (1880); *Scirpus apus* Gray, Proc. Am. Acad. 10:78 (1874), type loc. shore of Clear Lake, *Bolander.*

3. **F. thermalis** Wats. (Fig. 17.) Stems 1 to 2 feet high, bearing few to many spikelets in a simple or compound umbellate cluster; leaves $\frac{1}{2}$ to $\frac{2}{3}$ as tall as the stems; spikelets oblong-ovate, 4 to 5 (or 7) lines long; style hairy; achene whitish, broadly obovoid, flattened, the tubercle linear, nearly as long, soon deciduous.

Margins of hot springs: Southern California northward to Inyo Co. Nevada.

Locs.—Owens Valley, *Brewer* 2832; Arrowhead Sprs., *Parish* 5528.

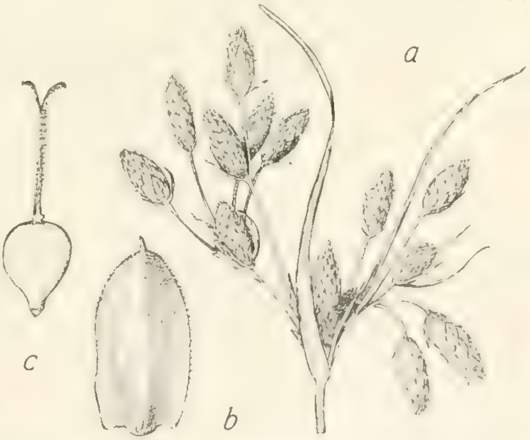

Fig. 17. FIMBRISTYLIS THERMALIS Wats. *a*, cluster of spikelets, × 1; *b*, scale, × 5; *c*, achene, × 5.

Ref.—FIMBRISTYLIS THERMALIS Wats. Bot. King 360 (1871), type loc. Hot Sprs., Ruby Valley, Nev., *Watson* 1216.

4. SCIRPUS L. Club-Rush. Bulrush.

Perennials or annuals. Stems leafy or the leaves reduced to mere sheaths at base. Spikelets terete or somewhat flattened, solitary or in heads, spikes or umbels, subtended by an involucre of 1 to several leaves or the involucre wanting. Perianth bristles 1 to 6, barbed or smooth, or none. Stamens 2 or 3. Style 2 or 3-cleft, not swollen at the base, deciduous or its base persistent on the achene. Achene triangular, lenticular or plano-convex.—Species 137, widely distributed in all lands. (Latin scirpus, bulrush.)

Bibliog.—Fernald, M. L., Representatives of Scirpus maritimus in America (Rhod. 2:239,—1900). Chase, A., N. Am. allies of Scirpus lacustris (Rhod. 6:65–71,—1904, with two excellent plates, 52 and 53).

Spikelets solitary and terminal; stems low, slender.—Subgenus Isolepis.
  Annual; involucral bract present.
    Scales obtuse or merely acute ....1. *S. cernuus.*
    Scales acute, shortly beaked, strongly keeled ....2. *S. carinatus.*
  Perennial; involucral bract none ....3. *S. pauciflorus.*
Spikelets in clusters; perennial.—Subgenus Euscirpus.
  Stems low; achene longitudinally ribbed and horizontally striate ....4. *S. setaceus.*
  Stems tall; achene not longitudinally ribbed.
    Bristles retrorsely barbed or ciliate, rarely wanting.
      Stems terete or nearly so; spikelets congested or umbellate.
        Stems leafy at base; spikelets in a sessile cluster ....5. *S. nevadensis.*
        Stems leafless; spikelets in an umbellate or congested cluster.
          Achenes (1 or) 1¼ to 1½ lines long, mostly ¼ to ⅓ longer than the scales.
            Umbels capitate or of a few short rays; bristles barbed ....6. *S. acutus.*
            Umbels long-rayed; bristles plumose ....7. *S. californicus.*
          Achenes 1 line long, nearly equaling the scales ....8. *S. validus.*
      Stems 3-angled.
        Stems with a single head or compact umbel.
          Involucral bract solitary; spikelets densely capitate-clustered, the inflorescence apparently lateral.
            Stems very slender, leafy below; scales awn-tipped ....9. *S. americanus.*
            Stems stout, leafless or mostly so; scales truncate or obtuse, quite awnless or with a minute point ....10. *S. olneyi.*
          Involucral leaves several, foliaceous; inflorescence terminal, the spikelets capitate, or in an umbel with unequal mostly short rays; leaves mainly basal.
            Awn of scale glabrous, smooth; achene plano-convex ....11. *S. campestris.*
            Awn of scale minutely scabrid; achene as if trigonous, in reality flat on one face, carinate-convex on the other ....12. *S. fluviatilis.*
        Stems bearing a panicle of irregular umbels, leafy to the top.
          Pedicels or raylets erect or spreading, bearing few to several sessile spikelets.
            Achenes rounded on the back; bristles 4 ....13. *S. microcarpus.*
            Achenes angled on the back; bristles 6 ....14. *S. congdonii.*
          Pedicels drooping, bearing a single spikelet ....15. *S. lineatus.*
    Bristles with the barbs pointed upward; mature heads conspicuously hairy on account of the elongated bristles ....16. *S. criniger.*

1. **S. cernuus** Vahl. Slender Club-Rush. Stems tufted, filiform or setaceous, 2 to 9 inches high, sheathed at base, the uppermost sheath often bearing a short slender blade; involucral bract 1 to 3 lines long or almost none; spikelet solitary, oblong-ovate, 1 to 1½ or 2 lines long; scales round-ovate, concave, obtuse or merely acute, lineate-carinate; style 3-cleft; achene brown, ⅓ line long, obovoid, flattish on one side, convex-rounded and with a fine median ridge on the other, finely or somewhat obscurely papillate, apiculate.

Springy or marshy places near the coast, from San Bernardino Valley to Humboldt Co. and north to Oregon. All continents.

Locs.—Elsinore, *McClatchie* 24: San Bernardino, *Parish;* Neponset, Salinas River, *Abrams* 4025; Carmel, *Ferguson* 297; Montara Pt., *Copeland* 3315; Oakland, *Bolander;* Lake Merced, San Francisco, *Greene;* Tiburon, *Harriet Walker;* Olema, *Davy* 4356; Eureka, *Tracy* 816.

Refs.—SCIRPUS CERNUUS Vahl, Enum. Pl. 2:245 (1806), type loc. western part of the Spanish peninsula. *S. riparius* Spreng. Syst. 1:208 (1825). *Isolepis riparia* R. Br. Prodr. Fl. N. Holl. 1:222 (1810), type loc. Port Jackson, Australia.

2. **S. carinatus** Gray. DWARF CLUB-RUSH. Stems tufted, slender, triangular, 1 to 2 inches high, shortly leaved at base; involucral bract 4 to 9 lines long; spikelet solitary, ovate, 1½ to 2 or 3 lines long; scales strongly keeled, acute, 2 to 3-nerved on the sides, the midrib excurrent as a short beak; achene strongly triangular, globose in outline, light-brown, ¾ line long, obscurely short-necked at base.

Swamps and low spots near the coast from Mendocino Co. to San Diego Co.

Locs.—Mendocino City, *Bolander* 4757; San Francisco, *Bolander*; Del Monte, *Heller* 6771.

Refs.—SCIRPUS CARINATUS Gray, Proc. Am. Acad. 7:392 (1867). *Isolepis carinata* H. & A.; Torr. Ann. Lyc. N. Y. 3:349 (1836), based on spms. from New Orleans, *Drummond*, and the Arkansas River, *Nuttall*.

S. NANUS Spreng. Pug. 1:4 (1813), type loc. Mansfeld, Germany. *Eleocharis pygmaea* Torr. Ann. Lyc. N. Y. 3:313 (1836). Stems capillary, flattened and grooved, 1 to 1½ inches high; roots with minute tubers; involucral bract present; spikelet 2 to 4 (or 8) -flowered, greenish; scales ovate; bristles longer than the achene, often wanting; achene obovate, triangular, smooth and shining.—Brackish shores or salt marshes, widely distributed throughout North America, Europe, north Africa. Occurs in Oregon and Washington (Piper and Beattie, Fl. Nw. Coast, 84). California material has been referred here (Cucamonga, acc. Pac. R. Rep. 4:152; Honey Lake Valley, *Davy* 3290), but the specimens are too young for certain determination.

3. **S. pauciflorus** Lightf. (Fig. 18.) Stems striate, 3-angled, leafless, slightly tufted, very slender (2½ to 4½ inches high), from slender rootstocks; spikelet solitary, terminal, 2 to 3 lines long, without involucral bracts, few (about 3)-flowered; scales narrow-ovate, obtusish; bristles 2 to 6, as long as the achene or longer; stamens 3; style 3-cleft; achene obovoid-oblong, rather strongly beaked.

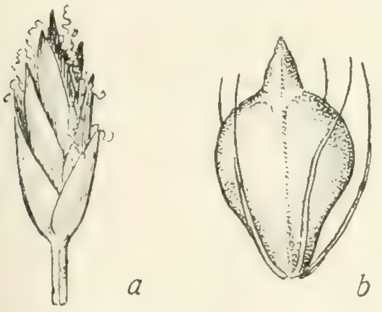

Fig. 18. SCIRPUS PAUCIFLORUS Lightf. *a*, spikelet, × 5; *b*, achene, × 16.

San Jacinto Mts. to the Sierra Nevada. Oregon to British Columbia, east to Maine. Europe, Asia.

Locs.—Round Valley, Mt. San Jacinto, *C. M. Wilder* 928; upper Santa Ana Cañon, San Bernardino Mts., *Hall* 7608; Bonita Mdw., Tulare Co., *Hall & Babcock* 5181; Truckee ranger station, *L. S. Smith* 694.

Ref.—SCIRPUS PAUCIFLORUS Lightf. Fl. Scot. 1078 (1777), type loc. Highlands of Scotland.

4. **S. setaceus** L. Stems caespitose, 4 to 5 inches high, twice as high as the leaves, the horizontal rootstocks very slender; involucral bracts 2 to 4 lines long; spikelets 1 or 2 in a place, narrow-ovate, 1½ lines long; scales more or less dark brown with a broad green midvein; achenes elliptic-obovoid, ½ line long, flattish on one side, convex and somewhat angled on the other, longitudinally and rather regularly ribbed, finely and horizontally striate between the ribs, apiculate.

Moist places, Humboldt Co. Europe, Asia, Africa, Australia.

Loc.—Salmon Creek Valley, *Tracy* 4817 (det. M. L. Fernald).

Ref.—SCIRPUS SETACEUS L. Sp. Pl. 49 (1753), type European.

5. **S. nevadensis** Wats. Stems clustered from a creeping rootstock, 9 to 18 inches high; leaves ½ to ⅔ height of the stems, ⅓ to ⅔ line wide, channeled, involute; spikelets chestnut-brown, oblong-ovate, 4 to 10 lines long, 3 or 4 ("to

8″) in a terminal sessile cluster; involucral bract narrowly linear or acicular, ½ to 1¼ inches long; scales ovate, obtusish, not awned; achenes nearly circular or round-ovate, flat on one face, rounded or hemispheric on the other; bristles 1 to 3, less than half the length of the achene.

Moist alkaline lands, east of the Sierra Nevada. Nevada to Washington.

Locs.—Mono Lake, *Brewer;* Amedee, *Davy* 3311.

Ref.—Scirpus nevadensis Wats. Bot. King, 360 (1871), type loc. Soda Lake, Carson desert, Nev., *Watson* 1213.

6. **S. acutus** Muhl. Tule. (Fig. 19.) Stems arising from stout creeping rootstocks, terete or very obtusely trigonous above, 3 to 9 feet high, leafless or with a short terete leaf from the upper basal sheath; inflorescence apparently lateral, 1 to 5 inches long; involucral bract stout, shorter than the inflorescence; spikelets 3 to 6 lines long, numerous, congested capitate, or in an irregular umbel with unequal rays; scales ovate, ciliate, shortly awned, ¼ to ⅓ longer than the achene; bristles 6, slender, retrorsely barbellate, slightly shorter than or about equaling the achene; style 2-cleft; achene lenticular, gray, abruptly mucronate.

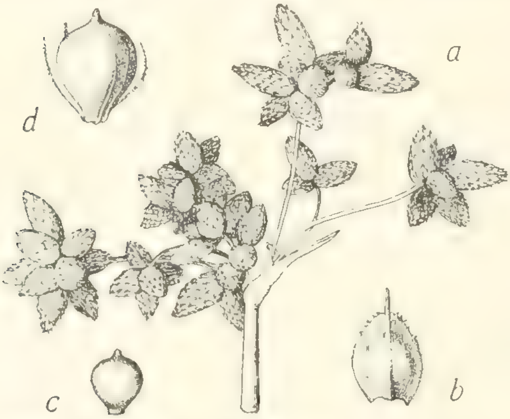

Fig. 19. Scirpus acutus Muhl. *a*, panicle of spikelets, × 1; *b*, scale, × 4; *c*, achene, × 4; d, achene and bristles, × 7.

Salt and freshwater marshes and borders of lakes and streams, very common: California to British Columbia, Newfoundland and Arizona.

Tax. Note.—The achene in this species is ⅓ larger than in S. validus and the scales nearly twice as long. The umbels are denser in S. acutus and the stems harder.

Econ. Note.—It is our estimate that originally there were in California about 250,000 acres of tule lands; much of this area has now been reclaimed to cultivation. Tule stems were used by the native tribes to build their balsas or small boats and to weave mats. At the present day the stems are used for packing nursery stock for shipment, thatching hay-stacks, and as a source of potash.

Locs.—Victorville, *Parish* 10561; Tehachapi, *Greene;* Bakersfield, *Davy* 2914; Hetch-Hetchy, *Jepson* 3415; Long Valley, Lassen Co., *Jepson* 7786; Gazelle, Shasta Valley, *Goldsmith* 16; Samoa, Humboldt Bay, *Tracy* 2595; Suisun Marshes, *Jepson* 2460a.

Refs.—Scirpus acutus Muhl.; Bigelow, Fl. Bost. 15 (1814), type loc. Fish Pond, Cambridge, Mass.; Fern. Rhod. 22:55 (1920). *S. occidentalis* Chase, Rhod. 6:68 (1904). *S. lacustris* var. *occidentalis* Wats. Bot. Cal. 2:218 (1880), type from western America.

7. **S. californicus** Britton. California Bulrush. Similar to S. occidentalis; umbel irregular, looser, its rays more slender, up to 4 inches long; spikelets dark reddish brown, cylindric or narrow-ovate, (3 or) 4 to 5 lines long; scales short-aristate; bristles 2, 3 or 4, ribbon-shaped, dark red, conspicuously short-hairy or somewhat plumose.

Marshes, California to Florida and South America.

Locs.—Oceanside, *Parish* 4455; Oak Knoll, Los Angeles Co., *Braunton* 659; Alvarado, *Jepson;* Vallejo, *M. Grace Rowe;* Suisun Marshes, *Jepson* 2460.

Refs.—Scirpus californicus Britton Trans. N. Y. Acad., 11:79 (1892). *Elytrospermum californicum* C. A. Mey. Mem. Sav. Etr. Petersb. 1:201, t. 2 (1830), type from California. *S. tatora* Kunth, Enum. Pl. 2:166 (1837), type loc. Peru.

8. **S. validus** Vahl. Great Bulrush. Stems 3 to 8 feet high from stout scaly rootstocks; basal sheaths soft, the hyaline margins soon lacerate; spikelets narrow-ovate, in clusters of 1 to 5, borne on the rays of a lax panicle; scales equaling or but little longer than the achene, roundish, ciliate, mucronate; bristles 4 or usually 5 or 6, retrorsely barbed, shorter than or usually slightly longer than the achene; style 2-cleft; achene broadly obovoid, plano-convex, apiculate.

Widely distributed in North America. Little known in California.

Locs.—Oro Fino, *Butler* 137; Russian River, s. Mendocino Co., *Heller* 5827 (det. C. V. Piper); Chinatown firth, Santa Ana River, *F. M. Reed* (acc. Agnes Chase). Probably overlooked elsewhere in California.

Refs.—Scirpus validus Vahl, Enum. Pl. 2:268 (1806), type from the West Indies. *S. lacustris* of Am. authors.

9. **S. americanus** Pers. Three Square. (Fig. 20.) Stems ¾ to 2 feet high, very slender, triangular, somewhat leafy; leaves short (the blade 1 to 3 inches long); involucral bract solitary, pungent, 1 to 4 inches long; spikelets 1 to 6, oblong-ovate, 3 to 7 lines long, borne in a single crowded sessile cluster; scales dark-brown, usually conspicuously tipped with a stout pale-colored awn about a line long; achene flat on one face, convex on the other and somewhat obscurely keeled; bristles 2 to 6, very unequal, the longer about as long as the achene.

Marshy, often brackish, places, occasional throughout California. North America, Chile.

Locs.—Panamint Cañon, *Hall & Chandler* 7041; Owens Lake, *Jepson* 5115; Mt. Pinos, *Hall* 6627; Eureka, *Tracy* 1765; Castle Rock, Sacramento River, *Goldsmith* 7; Honey Lake Valley, *Davy* 3286; Long Valley, Lassen Co., *Jepson* 7785.

Refs.—Scirpus americanus Pers. Syn. 1:68 (1805), type from the Carolinas. *S. pungens* Vahl, Enum. Pl. 2:255 (1806).

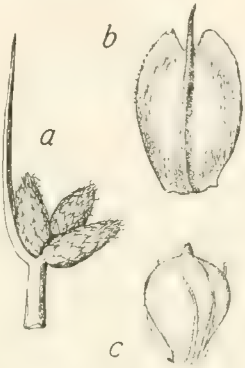

Fig. 20. Scirpus americanus Pers. *a*, cluster of spikelets, × 1; *b*, scale, × 5; *c*, achene and bristles, × 5.

10. **S. olneyi** Gray. Olney Bulrush. (Fig. 21.) Stems from the bulbous nodes of running rootstocks, 2 to 5 feet high or more, stout, triquetrous, sheathed at base, leafless or with a single very short leaf; involucral bract 1 to 1¼ inches long; spikelets 2 to 26 in a single crowded sessile cluster, oblong-ovate, 2 to 5 lines long; scales brown, elliptic, membranous, obtuse, glabrous or slightly ciliate; style 2-cleft; achene obovate, flattish on one side, convexish on the other, beaked, smooth.

Common in brackish marshes: California and Oregon, east to the Atlantic.

Locs.—Klamath Hot Sprs., *Goldsmith* 23; Suisun, *C. F. Baker* 3243; Newark, *Davy* 1109; Death Valley, *Jepson* 6939.

Refs.—Scirpus olneyi Gray, Jour. Bost. Soc. Nat. Hist. 5:30 (1845), type loc. Seekonk River, R. I., *Olney;* Jepson, Fl. W. Mid. Cal. 87 (1901).

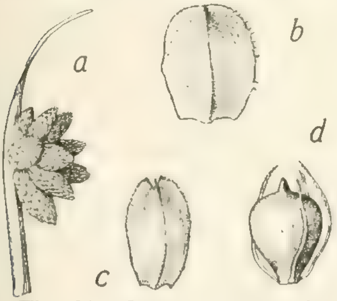

Fig. 21. Scirpus olneyi Gray. *a*, cluster of spikelets, × 1; *b*, scale (lower), × 5; *c*, scale from a different plant (upper), × 5; *d*, achene and bristles, × 5.

11. **S. campestris** Britton. Bull Tule. (Fig. 22.) Stems 1 to 3 feet high, stout, acutely triangular, the point of junction with the slender rootstock often

enlarged into hard woody tubers; leaves equaling or exceeding the stem, keeled, flat or deeply channeled, 2 to 4 lines wide; involucre of few unequal spreading foliaceous bracts 3 to 13 inches long, one much the longer and more erect; inflorescence terminal, the spikelets in clusters of 1 to 3, the clusters congested-capitate or commonly somewhat umbellate with unequal rays; rays ¼ to 1½ inches long; spikelets ovate or oblong-ovate, acute, 6 to 10 lines long; scales thinly scarious, obscurely puberulent or subglabrous, keeled, bifid or lacerate, with a short soon recurved subulate awn between the teeth; bristles 2 to 6, minutely and retrorsely scabrous, shorter than the achene; style 2-cleft; achene round-obovate, sublenticular, obtuse or truncatish, slightly apiculate, dark brown, shining.

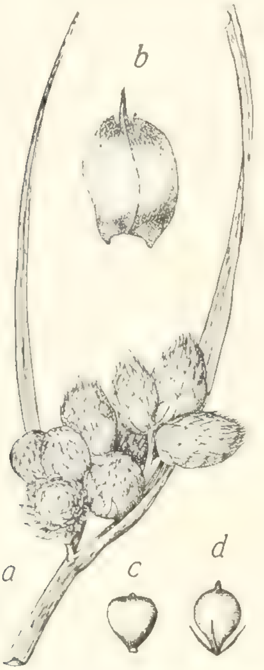

Fig. 22. Scirpus campestris Britton. *a*, cluster of spikelets, × 1; *b*, scale, × 3; *c*, achene, × 3; *d*, achene and bristles, × 3.

Salt marshes and moist alkaline soils: throughout California. North to Oregon and east to New Jersey.

Locs.—Ne. Modoc Co., *Manning;* Samoa, Humboldt Bay, *Tracy* 3099; Napa, *Jepson;* Suisun Marshes, *Jepson* 2459; Benicia, *Jepson* 7436; Alvarado, *Jepson;* Bakersfield, *Davy* 1826; San Bernardino, *Parish;* Imperial, *Parish* 8376. The typical form has whitish spikelets. The var. paludosus Fern. has drab or castaneous spikelets but does not differ otherwise. It has much the same range as the species in California.

Refs.—Scirpus campestris Britton, Ill. Fl. ed. 1, 1:267 (1896), type North American. *S. maritimus* Wats. Bot. Cal. 2:218 (1880), in part. *S. robustus* Jepson, Fl. W. Mid. Cal. 87 (1901). Var. *compactus* Davy in Jepson l.c. 88, type loc. Stege, *Davy* 4075; spikelets congested into dense heads. Var. *paludosus* Fern. Rhod. 2:241 (1900). *S. paludosus* Nelson, Bull. Torr. Club, 26:5 (1899), type loc. Granger, Wyo., *Nelson.* *S. pacificus* Britton; Parish, Bull. S. Cal. Acad. 4:8 (1905), type loc. s. Cal. coast.

12. **S. fluviatilis** Gray. Similar to S. campestris; bract of the inflorescence exceedingly elongated; scales minutely puberulent, subulate awn recurved; bristles exceeding the achene; achene brownish or drab, narrow-obovoid, flattish on one face, strongly carinate-keeled on the other, obscurely apiculate, shortly attenuate at base.

Borders of lakes and streams, probably throughout northern California but rarely collected. East to New Jersey.

Locs.—Honey Lake, *Davy* 3313; Sutter Co., *Copeland* 3263.

Refs.—Scirpus fluviatilis Gray, Man. 527 (1848). *S. maritimus* var. *fluviatilis* Torr. Ann. Lyc. N. Y. 3:324 (1836), type loc. w. New York, *Gray.*

13. **S. microcarpus** Presl. Panicled Bulrush. (Fig. 23.) Stems from stout creeping rootstocks, stout, triangular, leafy, 2 to 5 feet high; leaves flat, 4 to 8 lines wide; margins scabrid; involucre of several spreading foliaceous bracts, about 1 to 2 times as long as the inflorescence; spikelets 1 to 5 in terminal and axillary clusters, the clusters in an umbellate compound panicle; panicle large and open, the rays 1 to 6 inches long, the raylets ¼ to ¾ inch long; spikelets narrow-ovate, greenish or lead-colored, 1 to 2½ lines long; scales ovate, membranous, with broad green midrib; bristles 4, barbed to the base; stamens 2; style 2-cleft; achene pale, plano-convex, not angled on the back, abruptly short-beaked, ½ line long.

Common along streams and in fresh-water marshes: California to Alaska and Newfoundland.

Locs.—Cuyamaca Mts. (Bot. Cal. 2:219); Carmel, *Ferguson* 287; Mt. Hermon, Santa Cruz Mts., *M. Grace Rowe;* Lake Pilarcitos, San Mateo Co., *Davy* 765; Mt. Tamalpais, *Davy;* Guerneville, *Davy;* Moore Creek, Howell Mt., *Jepson* 6841; Mt. St. Helena, *Jepson* 7667; Eureka, *Tracy* 4628; Sisson, *Goldsmith* 24; Ft. Bidwell, Modoc Co., *Jepson* 7922; Sierra Valley, *Jepson* 8054a; Jackson, *Hansen* 637; Kennedy Mdws., Tuolumne Co., *A. L. Grant* 121, 448; Confidence, Tuolumne Co., *Jepson* 7696; Alder Creek, Yosemite Park, *Jepson* 4330a.

Refs.—Scirpus microcarpus Presl, Rel. Haenk. 1:195 (1828), type loc. Nootka Sound, Vancouver Isl. *S. sylvaticus* var. *digynus* Boeckl. Linnaea, 36:727 (1870).

14. **S. congdonii** Britton. Similar to S. microcarpus, but panicle less diffuse, its rays 3 to 6, 2 to 3½ inches long; spikelets densely capitate at the ends of the rays; style 3-cleft; bristles rather longer than the achene; achene oblong-obovate, flat on one face, angled on the back.

Sierra Nevada; very little known and rarely collected.

Locs.—Pine Ridge, Fresno Co., acc. Britton; Plumas Co., acc. Britton.

Refs.—Scirpus congdonii Britton, Torreya, 18:36 (1918), type loc. upper San Joaquin River, Madera Co., *Congdon.* *S. atrovirens* Wats. Bot. Cal. 2:219 (1880).

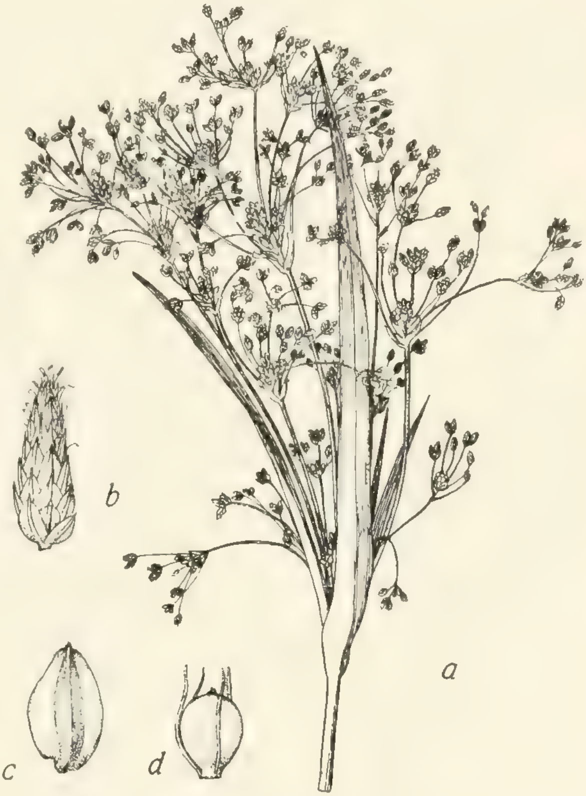

Fig. 23. Scirpus microcarpus Presl. *a,* panicle, × ½; *b,* spikelet, × 6; *c,* scale, × 9; *d,* achene, × 9.

15. **S. lineatus** Michx. Stems slender, triangular, from a stout rootstock, densely leafy at base, less leafy above, 1½ to 3 feet high; leaves flat, 3 to 6 lines wide, scabrous-margined; panicle of umbels compound, 2 to 5 inches long, the spikelets mostly solitary at the ends of the raylets, the very slender rays becoming pendulous; involucral bracts much shorter than the inflorescence; spikelets reddish brown, short-cylindric, (2 or) 4 to 6 lines long; scales ovate or oblong, short-awned, membranous with a green midvein; bristles 6, weak, entangled, smooth, equaling or exceeding the scales; stamens 3; style 3-cleft; achene obovoid, flat on one face, convex-ridged on the other, short-beaked, ½ line long.

Dry hills, Siskiyou Co. North to Oregon and east to the Atlantic.

Locs.—Yreka, *Butler* 857. Grants Pass, Oregon, *Howell.*

Ref.—Scirpus lineatus Michx. Fl. Bor. Am. 1:32 (1803), type from the Carolinas.

16. **S. criniger** Gray. (Fig. 24.) Stems ¾ to 3 feet high, triangular and striate; leaves 1½ to 4 inches long, 1½ to 2½ lines wide; spikelets 9 to 18, 5 to 7 lines long, congested in a sessile head; filaments slender, much exserted and exceeding the 6 very long bristles; style 3-cleft; achene oblong, sulcate-triangular, shortly beaked, 1 line long.

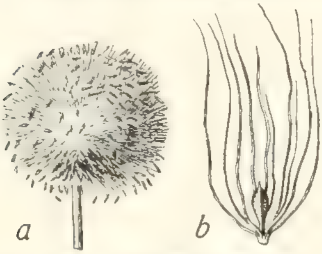

Fig. 24. SCIRPUS CRINIGER Gray. *a*, head of flowers, × 1; *b*, achene and bristles, × 3.

High mountains, Sierra Nevada, north to Siskiyou Co., thence south to Mendocino Co.

Locs.—Monarch Creek, Tulare Co., *Hall & Babcock* 5699; Peregoy Mdw., Yosemite Park, *Jepson* 4331; Mt. Dana, *Congdon;* Kennedy Lake, Tuolumne Co., *A. L. Grant* 508; Heather Lake, El Dorado Co., *Jepson* 8175; Placer Co., *Carpenter;* Siskiyou Mts., *Blasdale* (bristles almost smooth).

Ref.—SCIRPUS CRINIGER Gray, Proc. Am. Acad. 7:392 (1867), type loc. Red Mt., n. Mendocino Co., *Bolander.*

5. **ERIOPHORUM** L. COTTON-SEDGE.

Bog perennials with triangular or nearly terete stems from creeping rootstocks. Leaves linear or the uppermost reduced to sheaths. Spikelets terminal on a leafy or naked stem, solitary or clustered or umbellate, subtended by an involucre of leaf-like bracts or none. Scales membranous, 1 to 5-nerved. Perianth-bristles numerous, filiform, silky-white, becoming greatly elongated in fruit. Stamens 1 to 3. Style very slender and elongated, 3-cleft. Achene triangular.—Species 10, northern hemisphere. (Greek erion, wool, phora, crop, refering to the woolly heads.)

Bibliog.—Fernald, M. L., N. Am. Species of Eriophorum (Rhod. 7:81–92, 129–136,—1905).

1. **E. gracile** Koch. SLENDER COTTON-SEDGE. Stems subterete, weak and very slender, 1 to 2 feet high, with one or more erect, very narrow, triangular-channeled leaves; involucre of a single erect colored bract much shorter than the inflorescence; rays 4 to 6 lines long, slightly nodding, roughish-puberulent; spikelets 2 to 5, oblong, 3 to 4 lines long; scales lead-color or blackish; perianth bristles 6 to 7 lines long in fruit.

Cold swamps, San Francisco and Sonoma Co. northward. Boreal regions around the earth.

Locs.—Santa Rosa (Bot. Cal. 2:220); San Francisco (Zoe, 2:378). Var. CAURIANUM Fern. (Fig. 25.) Scales straw-color or brownish.—Northern Sierra Nevada and northward; Grass Lake near Luther Pass, El Dorado Co., *Jepson* 8090; Sisson, *Jepson.*

Refs.—ERIOPHORUM GRACILE Koch in Roth, Cat. Bot. 2:259 (1800), type European. Var. CAURIANUM Fern. Rhod. 7:87 (1905), based on spms. from Ore. (*Cusick*) and Cal. (Sierra Co., *Lemmon,* and Mt. Shasta, *Brown*).

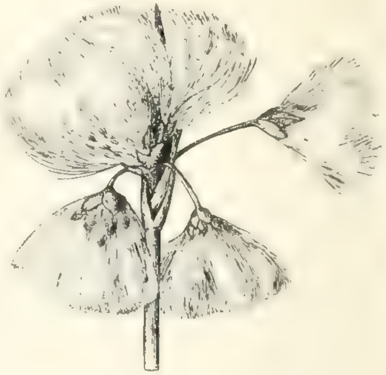

Fig. 25. ERIOPHORUM GRACILE Koch var. CAURIANUM Fern. Cluster of spikelets in fruit, × 1.

6. **HEMICARPHA** Nees & Arn.

Dwarf tufted annuals, with almost filiform stems and leaves. Spikelets small, terminal, terete, solitary or clustered, subtended by a 1 to 3-leaved involucre. Scales enclosing a minute hyaline bractlet between the flower and the axis of the spikelet. Perianth none. Stamen 1. Style 2-cleft. Achene subterete.—Species 3. (Greek hemi, half, and karpos, chaff, in reference to the inner bractlet.)

Bibliog.—Coville, F. V., Genus Hemicarpha in N. Am. (Bull. Torr. Club 21:34–37,—1894). Britton, N. L., Genus Hemicarpha (Ill. Fl. ed. 2, 1:339–340,—1913).

Scales spreading only at the tip or erect, little exceeding the achenes ....1. *H. micrantha.*
Scales spreading, 2 to 3 times as long as the achenes ....2. *H. occidentalis.*

1. **H. micrantha** Pax. Stems ¾ to 1¼ inches high, sheathed at base with 1 or 2 short filiform leaves; involucral bract ½ to 6 lines long; spikelets 1 to 3, ovate, reddish-brown, 1 to 1½ lines long; scales cuneate-obovate, short-acuminate and slightly spreading at the tip or erect, little longer than the (¼ line long) achene; bractlet adherent to the achene.

San Diego Co. and Sierra Nevada foothills. Washington to the Atlantic and South America.

Locs.—Jacksonville bridge, Tuolumne River, *A. L. Grant* 580; San Diego, *Orcutt* (acc. Gray Herb.). Var. **aristulata** Cov. Stems 4 to 8 inches high; spikelets conspicuously squarrose by reason of the abruptly attenuate scales; achenes black.—Great Plains region; also Washington and California acc. Britton, Ill. Fl. ed. 2, 1:340 (1913).

Refs.—HEMICARPHA MICRANTHA Pax; Engler & Prantl, Nat. Pflzr. 2^2:105 (1887). *Scirpus micranthus* Vahl, Enum. Pl. 2:254 (1806). *H. subsquarrosa* Wats. Bot. Cal. 2:220 (1880). Var. ARISTULATA Cov. Bull. Torr. Club 21:36 (1894), type from Texas, *Nealley*. *H. aristulata* Smyth, Trans. Kans. Acad. Sci. 16:163 (1899); Nelson, Bull. Torr. Club, 29:400 (1902).

2. **H. occidentalis** Gray. (Fig. 26.) Similar; stems 1 to 2 inches high; spikelets greenish, broadly ovate; scales ¾ to 1 line long, the body oblong or lanceolate, 3 or 4-nerved, abruptly tapering into a spreading awn-like tip 1 to 1½ times as long; bractlet not adherent to the achene; achene brownish, narrow-obovoid, somewhat flattened.

Middle altitudes: cismontane Southern California; Sierra Nevada. North to Washington.

Locs.—Lake Surprise, Mt. San Jacinto, *F. M. Reed* 2443; Bluff Lake, San Bernardino Mts., *Parish* 3268; Yosemite, *Congdon;* Jacksonville Bridge, Tuolumne River, *A. L. Grant* 580a.

Ref.—HEMICARPHA OCCIDENTALIS Gray, Proc. Am. Acad. 7:391 (1868), type loc. Yosemite, *Bolander.*

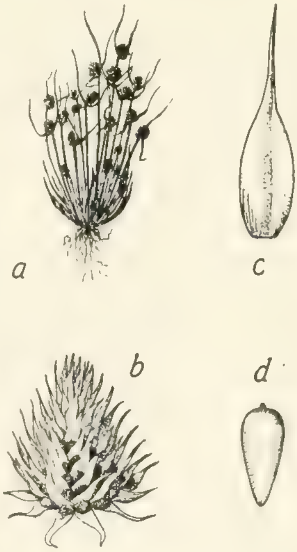

Fig. 26. HEMICARPHA OCCIDENTALIS Gray. *a*, entire plant, × 1; *b*, spikelet, × 8; *c*, scale, × 18; *d*, achene, × 18.

7. SCHOENUS L.

Mostly perennials with rush-like tufted rigid stems. Leaves semi-terete, basal, the sheaths dark-colored. Spikelets 1 to 6-flowered, aggregated in a terminal cluster. Scales in 2 ranks, the lower ones empty, the upper with perfect or pistillate flowers, the uppermost with staminate flowers or empty. Perianth of 3 to 6 plumose or smooth bristles or none. Stamens usually 3. Style-branches 3. Achene 3-angled, without a tubercle.—Species 61, mostly in New Zealand and Australia but also occurring in North and South America, Europe and Africa. (Greek schoinos, a rush.)

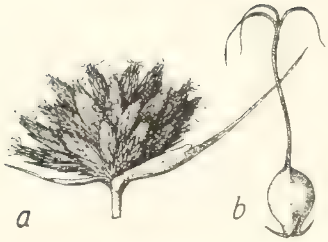

Fig. 27. Schoenus nigricans L. *a*, cluster of spikelets, × 1; *b*, achene, × 5.

1. **S. nigricans** L. Black Galingale. (Fig. 27.) Perennial; stems 10 to 20 inches high, surpassing the erect rigid pungent leaves; heads 5 to 7 lines high, dark chestnut-color; spikelets flattened; bristles naked in our form; achene white.

Alkaline soil, Southern California. Nevada, Texas, Florida. Europe, Africa, Asia.

Locs.—Lone Pine Cañon, Cajon Pass, *Parish* 2058; Arrowhead Sprs., *Geo. B. Grant;* Furnace Creek, Death Valley (acc. Contrib. U. S. Nat. Herb. 4:213).

Ref.—Schoenus nigricans L. Sp. Pl. 43 (1753), type European.

8. CLADIUM P. Br. Saw-Grass.

Very tall leafy perennials. Stems terete (in ours), from stout rootstocks. Leaves much elongated, serrate on the margin and folded on the midrib so as to be channeled above. Spikelets small, few-flowered, borne in terminal and lateral compound panicles and consisting of several loosely imbricated scales; lower scale empty, the middle one or two bearing staminate flowers, the upper one usually perfect and fertile. Stamens in ours 2. Style 2 or 3-cleft, deciduous. Achene ovoid or globose, without tubercle.—Species 45, tropical and temperate regions. (Diminutive of Greek klados, a branch, referring to the branched inflorescence.)

1. **C. mariscus** R. Br. Stems numerous, stout, 6 to 10 feet high, forming very dense and heavy hummocks; leaves 4 to 7 feet long, 4 to 5 lines broad; panicles diffuse, drooping, the lateral ones 4 to 8 in number, from the axils of short sheathing leaves; spikelets narrowly oblong, 2 lines long, in clusters of 2 or 3; achene brown, cylindric-ovate, 1 to 1¼ lines long.

Moist ground, south bases San Gabriel and San Bernardino mountains; Inyo Co. Southern Nevada. All continents.

Locs.—Upland (acc. *Parish*, Bot. Gaz. 65:335); Hanaupah Cañon, Panamint Mts., *Jepson* 7002; Furnace Creek (acc. Coville, Contrib. U. S. Nat. Herb. 4:213,—1893).

Refs.—Cladium mariscus R. Br. Prodr. Fl. Nov. Holl. 1:236 (1810). *C. mariscus* var. *californicum* Wats. Bot. Cal. 2:224 (1880), type loc. San Gabriel, *Brewer*.

9. RYNCHOSPORA Vahl.

Chiefly perennials with erect more or less leafy and triangular stems from rootstocks. Spikelets ovate, globular, or fusiform, variously clustered; scales plane or a little concave, not keeled, the uppermost subtending imperfect flowers. Perianth of 1 to 20 bristles. Stamens commonly 3 (in ours usually 2). Style 2-cleft. Achene lenticular or globular, crowned by the persistent base of the style.—Species about 189, tropics and subtropic regions of both hemispheres. (Greek rhyncos, snout, and spora, seed.)

1. **R. alba** Vahl. White-beak Rush. Perennial; stems almost filiform, 1½ to 2 feet high; leaves narrowly linear or almost bristle-like; spikelets disposed in a head-like terminal corymb (and usually 1 or 2 lateral ones), white or whitish, becoming tawny with age, perfecting only a single flower; bristles 9 to 12 (or 20); tubercle flattened, triangular-subulate, nearly as long as the achene.

Bogs, North Coast Ranges, rare in California. North America, Europe, Asia.

Loc.—Mendocino Co., *Congdon* (acc. Fernald and MacBride).

Refs.—Rynchospora alba Vahl, Enum. Pl. 2:236 (1806). *Schoenus albus* L. Sp. Pl. 44 (1753), type north European.

10. **CAREX** L. Sedge.

By K. K. Mackenzie[1]

Grass-like sedges, perennial by rootstocks. Culms (stems) mostly triangular, often strongly phyllopodic (leafy at base) or aphyllopodic (not leafy at base). Leaves 3-ranked, the upper (bracts) elongate or short, and subtending the spikes of flowers or wanting. Flowers monoecious or sometimes dioecious. Spikes 1 to many, either wholly pistillate, wholly staminate, androgynous or gynaecandrous, sessile or peduncled, the base of the peduncle often with a perigynium-like or spathe-like organ (clado-prophyllum) surrounding it. Perianth none. Stamens 3 (or rarely 2). Achene 3-angled, lenticular or plano-convex, completely enclosed by the sac-like perigynium.—Species more than 1000, all continents, but least developed in the tropics. (The Latin name.)

Tax. note.—The style is either (1) jointed with the achene and withering and at length deciduous, as in most sections, or (2) continuous with the achene, persistent, indurated and not withering, as in Sects. 30, 33, 34, and sometimes in Sect. 31. The racheola is occasionally developed.

Bibliog.—Bailey, L. H., Untenable Names of Carices, in Bull. Torr. Club, 11:18-19,—1884; Carex Catalogue 1-4,—1884; Notes on Carex I, in Bot. Gaz. 9:117-122,—1884; II, in Bot. Gaz. 9:137-141,—1884; III, in Bot. Gaz. 10:203-208,—1885; IV, in Bot. Gaz. 10:293-296,—1885; V, in Bot. Gaz. 10:317-319,—1885; VI, in Bot. Gaz. 10:379-382,—1885; VII, (Preliminary synopsis of N. Am. Carices) in Proc. Am. Acad. 22:59-157,—1886; VIII, in Bot. Gaz. 11:328-330,—1886; IX, in Bot. Gaz. 13:82-89,—1888; X, in Jour. Bot. 26:321-323,—1888; XI (Studies of the types of various species of the genus Carex), in Mem. Torr. Club 1:1-85,—1889; XII, in Bull. Torr. Club 16:218-220,—1889; XIII, in Bull. Torr. Club 17:61-64,—1890; XIV, (Carex rigida Gooden. and its varieties), in Jour. Bot. 28:171-173,—1890; XV, in Proc. Cal. Acad. ser. 2, 3:104-106,—1891; XVI, in Bot. Gaz. 17:148-153,—1892; XVII, in Bull. Torr. Club 20:417-429,—1893; XVIII, in Bot. Gaz. 21:1-8,—1896; XIX, in Bot. Gaz. 25:270-272,—1898. Boott, Francis, On a species of Carex allied to C. saxatilis L., in Trans. Linn. Soc. 19:215-220,—1843; Description of six new N. Am. Carices, in Jour. Bost. Nat. Hist. Soc. 5:112-116,—1845; Caricis species novae vel minus cognitae, in Trans. Linn. Soc. 20:115-147,—1845-6; De Caricibus, in Hooker's Lond. Jour. Bot. 5:67-74,—1846; Table of distrib. of Carex, in Richards. Arctic Exped. 2:344-353,—1851; [Carices in Bigelow coll.] Pac. R.R. Rep. 4:153-154,—1856; Ill. of Genus Carex, I:1-74, t. 1-200,—1858; II:75-103, t. 203-310,—1860; III:104-126, t. 311-411,—1862; IV:127-233, t. 412-600,—1867. Boott, William, Carex, in Wats. Bot. Cal. 2:224-253,—1880; Notes on Cyperaceae, in Bot. Gaz. 9:85-94,—1884. Brown, Robert, Carex, in Supp. Appendix Parry's Voyage,—1823; Carex in Bot. Appendix Richardson's Jour.,—1823. Dewey, Chester, Caricography, nos. 1-198, in Am. J. Sci. ser. 1, vols. 7-49,—1824-1845; nos. 199-303, in ser. 2, vols. 2-42,—1846-1866; index, in vol. 42:325-334,—1866. Holm, T., Studies in the Cyperaceae, I-XXVI, in Am. J. Sci. ser. 4, vols. 1-26,—1896-1908; Genus Carex in Nw. Am. in Bot. Centralbl. Beihefte, 22^2:1-29,—1909. Fernald, M. L., Northeastern Carices of the Subsect. Vesicariae, in Rhod. 3:43-56,—1901; Northeastern Carices of the Sect. Hyparrhenae, in Proc. Am. Acad. 37:447-514,—1902; various notes on Carex, in Rhod. 2:170-171,—1900; 3:170-172,—1901; 4:218-230,—1902; 5:247-251,—1903; 8:45-47, 73-77, 165-167, 181-184, 200-202,—1906; 9:159-160,—1907; 10:47-48,—1908; 12:135-136,—1910; 13:130, 243-248,—1911; 14:115-116,—1912 (with K. M. Wiegand); 15:92-93, 133-134, 186-187,—1913; 16:213-214,—1914; 17:158-159,—1915. Kükenthal, Georg, Carex in Engler, Pflzr. 4^{20}:67-824, figs. 1-128,—1909. Mackenzie, Kenneth K., Notes on Carex I, in Bull. Torr. Club 33:439-443,—1906; II, 34:151-155,—1907; II, 34:603-607,—1907; IV, 35:261-270,—1908; V, 36:477-484,—1909; VI, 37:231-250,—1910; VII, 40:529-554,—1913; VIII, 42:405-422,—1915; IX, 42:603-621,—1915; X, 43:423-434,—1916; XI, 43:601-620,—1916; Mr. Heller's 1908 Carex coll., in Muhl. 5:53-58,—1909; Western allies of Carex pennsylvanica, in Torreya 13:14-16,—1913; 14:125-127, 144-159,—1914; Monog. of Cal. species of Carex, in Erythea 8:7-95, figs. 1-51,—1922. Olney, S. T., Carices Novae, in Proc. Am. Acad. 7:393-396,—1868; Carices coll. by E. Hall, in Proc. Am. Acad. 8:406-407,—1872. Schkuhr, C., Riedgraser,—1801; Nachtrag oder die zweite halfte der Riedgraser,—1806. Schweinitz, L. D. von, Analytical table of N. Am. species of Carex, in Ann. Lyc. Nat. Hist. N. Y. 1:62-71,—1824; Monog. N. Am. species of Carex, l.c. 1:283-373,—1825 (edited by Torrey). Torrey, J., Monog. N. Am. Cyperaceae, in Ann. Lyc. Nat. Hist. N. Y. 3:386-427, 443,—1836.

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[1] The ranges for California and the indications of altitude have been in large part written by W. L. Jepson on the basis of determinations by Mr. Mackenzie. The references to the literature under the species have also been somewhat modified to conform to the general usage in this work.—W. L. J.

A. Spike one, androgynous, bractless; perigynia glabrous, beaked, the beak with closed suture at apex dorsally.

Achenes triangular; stigmas three, rarely two.
Pistillate scales persistent; perigynia inflated, sessile, not becoming reflexed....1. INFLATAE.
Pistillate scales deciduous; perigynia not inflated, stipitate, at least the lower reflexed at maturity ....2. ATHROCHLAENAE.
Achenes lenticular; stigmas two..........3. CAPITATAE.

B. Spikes one to many; if one, not as in A.

1. *Achenes lenticular and stigmas two; lateral spikes sessile; terminal spike partly pistillate, or if staminate the lateral spikes short or heads dioecious.*

Perigynia not white-puncticulate.
Rootstocks long-creeping, the culms arising singly or few together; perigynia with beak obliquely cut, at most bidentulate.
Spikes densely aggregated into a globose or ovoid head, appearing like one spike.......... 4. FOETIDAE.
Spikes, at least the lower, distinct..........5. DIVISAE.
Cespitose or rootstocks short-creeping; perigynia obliquely cut to deeply bidentate.
Spikes androgynous (i.e., staminate flowers uppermost).
Perigynia abruptly contracted into the beak.
Spikes few (usually ten or less); perigynia green or tinged with reddish-brown. 6. MUHLENBERGIANAE.
Spikes numerous; perigynia yellowish or brownish at flowering.
Perigynia yellowish; opaque part of leaf-sheath usually transversely rugulose. 7. MULTIFLORAE.
Perigynia brownish; opaque part of leaf-sheath not transversely rugulose. 8. PANICULATAE.
Perigynia tapering into the beak..........9. STENORHYNCHAE.
Spikes gynaecandrous (i.e., pistillate flowers uppermost).
Perigynia at most thin-edged.
Perigynia spreading or ascending at maturity..........10. STELLULATAE.
Perigynia appressed..........11. DEWEYANAE.
Perigynia narrowly to broadly wing-margined..........12. OVALES.
Perigynia white-puncticulate..........13. CANESCENTES.

2. *Achenes triangular and stigmas three, or lenticular and stigmas two; if lenticular, lower lateral spikes conspicuously peduncled, or terminal spike staminate and lateral spikes elongated.*

Staminate and pistillate spikes on different culms; stigmas 3, short..........17. SCIRPINAE.
Staminate and pistillate spikes on the same culms.
Spike solitary.
Perigynia many-nerved, rounded and beakless at apex; stigmas 3, short.......... 14. POLYTRICHOIDEAE.
Perigynia 2-keeled, not rounded at apex, beakless or beaked.
Perigynia glabrous; stigmas 3, elongated ....15. FIRMICULMES.
Perigynia pubescent or puberulent; stigmas 3..........16. FILIFOLIAE.
Spikes more than one.
Perigynia closely enveloping the achene, strongly tapering at base, pubescent or puberulent; bracts sheathless or nearly so; stigmas normally 3, long......18. MONTANAE.
Perigynia not as above; or if so, at least the lowest bract strongly sheathing.
Bracts (at least lowest) long-sheathing, more or less purplish-tinged, the blades absent or rudimentary; stigmas 3, early deciduous..........19. DIGITATAE.
Lowest bract sheathless or long-sheathing; if long-sheathing its blade well-developed.
Lowest bract strongly sheathing; perigynia never strongly bidentate with stiff teeth.
Achenes lenticular; stigmas 2..........20. BICOLORES.
Achenes triangular; stigmas 3.
Scales greenish or light reddish-brown or purplish tinged.
Rootstocks long-creeping; scales purplish tinged..........21. PANICEAE.
Rootstocks not long-creeping; scales greenish to reddish-brown tinged.
Perigynia glabrous or hispidulous; leaves not pubescent.
Pistillate spikes erect on stiff peduncles..........22. LAXIFLORAE.
Pistillate spikes slender on slender peduncles, the lower drooping..........24. DEBILES.
Perigynia or leaves or both strongly pubescent.........23. TRIQUETRAE.
Scales dark reddish-brown to blackish tinged..........25. FRIGIDAE.
Lowest bract sheathless or sheathing; if sheathing, perigynia strongly bidentate with stiff teeth.

Perigynia or leaves or both pubescent; stigmas 3......31. Hirtae.

Neither perigynia nor leaves pubescent.

Style jointed with the achene, deciduous.

Achenes triangular; stigmas 3.

Lowest bract sheathless; perigynia not bidentate.

Pistillate spikes narrowly cylindric, elongated......26. Anomalae.

Pistillate spikes ovoid, oblong or linear......27. Atratae.

Lowest bract sheathing; perigynia bidentate......32. Extensae.

Achenes lenticular; stigmas 2.

Achenes not constricted in the middle......28. Acutae.

Achenes constricted in the middle; scales sharp-pointed, three-nerved. 29. Cryptocarpae.

Style persistent, continuous with the achene.

Perigynia nerveless, except for the marginal nerves; stigmas 3...... 30. Trachychlaenae.

Perigynia several to many-nerved.

Perigynia coarsely ribbed; stigmas 3 or 2......33. Physocarpae.

Perigynia finely and closely ribbed; stigmas 3...... 34. Pseudo-cypereae.

1. Inflatae.

Pistillate scales 1-nerved; perigynia ovoid, inflated, tapering at apex; staminate part of spike scarcely conspicuous; achenes 1.25 to 1.5 mm. long......1. *C. engelmanii.*

Pistillate scales 3-nerved; perigynia broadly ovoid, strongly inflated, abruptly minutely-beaked; staminate part of spike conspicuous; achenes 2 mm. long......2. *C. breweri.*

2. Athrochlaenae.

Represented by one species in our range......3. *C. nigricans.*

3. Capitatae.

Represented by one species......4. *C. capitata.*

4. Foetidae.

Represented by one species in our range......5. *C. vernacula.*

5. Divisae.

Rootstocks, slender, light-brownish; culms obtusely triangular, normally smooth; leaf-blades narrow, involute......6. *C. douglasii.*

Rootstocks stout; culms acutely triangular, normally rough above.

Perigynia chestnut, thick, the beak about one-fifth as long as the body......7. *C. simulata.*

Perigynia blackish in age, the beak one-third to one-half as long as the body.

Scales very dark chestnut-brown, shining; perigynia 3.5 to 4.5 mm. long, polished, scarcely hyaline at orifice......8. *C. pansa.*

Scales lighter colored, dull; perigynia 3 to 4 mm. long, dull, strongly hyaline at orifice. 9. *C. praegracilis.*

6. Muhlenbergianae.

Densely cespitose; head orbicular or oblong-ovoid......10. *C. hoodii.*

Rootstocks elongate; head linear, interrupted......11. *C. tumulicola.*

7. Multiflorae.

Scales strongly hyaline-margined; sheaths normally not cross-rugulose.

Perigynia lanceolate-ovate, sharp-margined to base, membranaceous, straw-colored...... 12. *C. stenoptera.*

Perigynia ovate, truncate at base, short-beaked, sharp-margined above, not membranaceous, brownish-black at maturity......13. *C. alma.*

Scales not strongly hyaline-margined; sheaths normally more or less cross-rugulose; perigynia straw-colored, yellowish or tawny at maturity, sharp-margined to base.

Perigynia 3.5 to 4.5 mm. long, the beak much shorter than the body; pistillate scales (except lowest) acute or cuspidate.

Ligule conspicuous, as long as wide; scales brownish-tinged; perigynia strongly nerved ventrally......14. *C. densa.*

Ligule very short; scales reddish-brown-tinged.

Perigynia flat and nerveless or nearly so ventrally, the body sparingly serrulate above, contracted into a beak......15. *C. vicaria.*

Perigynia low-convex and strongly nerved ventrally, the body strongly serrulate above, abruptly contracted into a beak......16. *C. breviligulata.*

Perigynia 2.25 to 3.25 mm. long, the beak about length of the body; pistillate scales strongly awned......17. *C. dudleyi.*

8. Paniculatae.

Leaf-blades 1.25 mm. wide; head little interrupted; perigynia 2 to 2.75 mm. long, shining, not concealed by the scales......18. *C. diandra.*

- Leaf-blades 2.5 to 6 mm. wide; head interrupted, compound; perigynia 3 to 4 mm. long, dull, concealed by the scales........19. *C. cusickii.*

9. Stenorhynchae.

- Perigynia 3 to 4 mm. long, the beak much shorter than the body; scales strongly dark-tinged.
  - Leaves clustered at base; sheaths not green and white mottled dorsally; culms slender........20. *C. jonesii.*
  - Leaves not clustered at base, the lower blades much reduced; sheaths green and white mottled dorsally; culms stout........21. *C. nervina.*
- Perigynia 4 to 6 mm. long, the beak about length of body; scales not or scarcely dark-tinged.
22. *C. stipata.*

10. Stellulatae.

- Spikes more or less widely separate, not brownish-black.
  - Body of perigynium broadest near middle; beak with few weak serrulations........23. *C. laeviculmis.*
  - Body of perigynium broadest near base; beak strongly serrulate.
    - Beak of perigynium bluntly bidentate, ¼ to ⅓ length of body, the ventral suture obsolete or inconspicuous; scale obtuse, ½ length of body of perigynium........24. *C. interior.*
    - Beak of perigynium sharply bidentate, the ventral suture conspicuous.
      - Beak of perigynium chestnut-brown tipped; culms obtusely triangular; pistillate scales obtuse or obtusish, chestnut-brown tinged with broad shining margins and apex, rounded and not keeled, the midvein obscure at apex.
        - Spikes widely separate, the terminal long-clavate; perigynia 3.5 to 4 mm. long. 25. *C. ormantha.*
        - Spikes approximate, the terminal short-clavate; perigynia 3.75 to 4.5 mm. long. 26. *C. phyllomanica.*
      - Beak of perigynium reddish-brown tipped; culms sharply triangular; pistillate scales obtusish to cuspidate, yellowish-brown tinged, the margins and apex narrow, opaque or dull whitish, keeled with the sharp midvein which is prominent to apex........27. *C. angustior.*
- Spikes 3 to 5 in a small (6 to 10 mm. long), densely capitate, brownish-black head....28. *C. illota.*

11. Deweyanae.

- Perigynia shallowly bidentate, 3.5 to 4 mm. long, the beak about ⅓ length of body........29. *C. leptopoda.*
- Perigynia deeply bidentate, 4 to 4.5 mm. long, the beak about ½ length of body........30. *C. bolanderi.*

12. Ovales.

- Sheaths green-striate opposite blades, except at mouth........31. *C. feta.*
- Sheaths white-hyaline opposite blades.
  - Sheaths strongly prolonged upward at mouth opposite blade in a very membranaceous appendage; perigynia and scales greenish........32. *C. fracta.*
  - Upper sheaths (at least) concave or truncate at mouth opposite blades.
    - Beak of perigynium flat and serrulate to usually strongly bidentate tip.
      - Perigynia 3.5 to 5 mm. long, 2 to 3 mm. wide.
        - Perigynia thin with margins conspicuously wrinkled dorsally; culms 1 to 4 dm. high; spikes ovoid, densely capitate........33. *C. straminiformis.*
        - Perigynia thick with margins not wrinkled dorsally; culms 3 to 9 dm. high; spikes oblong in an oblong head........34. *C. multicostata.*
      - Perigynia 3 to 3.5 mm. long, 1 to 1.5 mm. wide........35. *C. subfusca.*
    - Beak of perigynium terete toward apex, the upper 1 to 3 mm. smooth or nearly so.
      - Perigynia appressed, nearly or entirely covered by scales, the beaks not conspicuous in the spikes.
        - Culms slender; spikes in a flexuous nodding head........36. *C. practicola.*
        - Culms stiff; spikes approximate in an erect head.
          - Culms 1 to 6 dm. high, the leaves not bunched near base; blades 2 to 3 mm. wide, flat; beak of perigynium not hyaline at orifice........37. *C. tracyi.*
          - Culms 1 to 3 dm. high, in large tufts, the leaves bunched near base; blades 1.5 to 2 mm. wide, more or less involute; perigynium beak hyaline at orifice.
            - Perigynia oblong-ovate, rather strongly margined........38. *C. phaeocephala.*
            - Perigynia linear-lanceolate, very narrowly margined, boat-shaped........39. *C. leporinella.*
      - Upper part of perigynia conspicuous in the spikes, not covered by scales.
        - Perigynia lanceolate, 5.5 to 8.5 mm. in length, 3 to 5 times as long as wide.
          - Spikes about three, not capitate; scales little more than ½ length of perigynia. 40. *C. davyi.*
          - Spikes 6 to 12, capitate; scales equaling bodies of perigynia....41. *C. specifica.*

Perigynia ovate or if lanceolate shorter than 5.5 mm. in length.
Lower bracts leaflet-like, much exceeding head.
Perigynia with the beak ferruginous at orifice, bidentate; lowest bract appearing like a continuation of the culm............42. *C. unilateralis.*
Perigynia with the beak hyaline at orifice, bidentulate; lowest bract not appearing like a continuation of the culm..........43. *C. athrostachya.*
Lower bracts scale-like, much shorter than or slightly exceeding head.
Perigynia with membranaceous or submembranaceous walls.
Perigynia thin and flat save where distended by achene.
Perigynia 3.5 to 5 mm. long; culms slender..............44. *C. festivella.*
Perigynia 4.5 to 6 mm. long; culms low, ascending or decumbent. 45. *C. nubicola.*
Perigynia strongly plano-convex at maturity.
Perigynia nerveless ventrally or with impressed nerves...................... 46. *C. pachystachya.*
Perigynia with conspicuously raised nerves on inner face.
Perigynia conspicuously hyaline-tipped; spikes densely capitate..47. *C. abrupta.*
Perigynia reddish-tipped; spikes more or less strongly separate. 48. *C. mariposana.*
Perigynia with thick, firm walls.
Perigynia very small (2.25 to 3.5 mm. long).
Margins of perigynia entire (or very obscurely subserrulate)........... 49. *C. integra.*
Margins of perigynia strongly serrulate............50. *C. teneraeformis.*
Perigynia longer (3.5 mm. long or more).
Lower bracts (at least) strongly amplectant; beaks of perigynia and scales little reddish-tinged.....................51. *C. amplectens.*
Bracts not amplectant; beaks of perigynia and scales strongly reddish-tinged.
Perigynia strongly nerved ventrally, the nerves prominent; scales with sharply defined midvein.
Sterile shoots not conspicuous; lower bladeless sheaths short; culms slender; scales mostly acute, reddish-brown........ 52. *C. harfordii.*
Sterile shoots numerous, elongate; lower bladeless sheaths very long; culms very slender; scales cuspidate or short-awned, yellowish-brown....53. *C. montereyensis.*
Perigynia nerveless or very obscurely nerved ventrally.
Perigynia with a few raised nerves dorsally; coastal species.
Spikes strongly capitate; leaf-blades averaging 2.5 to 3 mm. wide; culms 3.5 to 12 dm. high .... 54. *C. sub-bracteata.*
Spikes not capitate, the head slender; leaf-blades averaging 1.5 to 2 mm. wide; culms 1 to 6 dm. high.......... 55. *C. gracilior.*
Perigynia many-striate or with impressed nerves dorsally; species of the Sierra Nevada.
Spikes not few-flowered; culms slender; leaves not clustered, the blades long................56. *C. pachycarpa.*
Spikes 6 to 12-flowered; culms stiff; leaves clustered, the blades short....................................57. *C. paucifructus.*

13. Canescentes.

Spikes androgynous; perigynia unequally biconvex..58. *C. disperma.*
Spikes gynaecandrous; perigynia plano-convex.
Perigynia broadest near middle, short-beaked, smooth or little roughened....59. *C. canescens.*
Perigynia ovate, broadest near the base; beak conspicuous, strongly serrulate....60. *C. arcta.*

14. Polytrichoideae.

Represented by one species...61. *C. leptalea.*

15. Firmiculmes.

Not stoloniferous; culms smooth, terete; leaf-blades 1.5 mm. wide; bracts long-awned.................. 62. *C. multicaulis.*
Stoloniferous; culms very rough, triangular; leaf-blades 2 to 3.5 mm. wide; bracts not long cuspidate...63. *C. geyeri.*

16. Filifoliae.

Represented by one species in our range...64. *C. exserta.*

17. Scirpinae.

Represented by one species in our range .... 65. *C. gigas.*

18. Montanae.

- Basal spikes not developed .... 66. *C. inops.*
- Basal spikes present.
  - Perigynia finely many-ribbed as well as strongly 2-keeled.
    - Scales purplish-tinged, obtuse to cuspidate; body of perigynium globose; staminate spikes many-flowered; basal pistillate spikes on elongated very slender peduncles. 67. *C. globosa.*
    - Scales reddish brown tinged, cuspidate or long-awned; body of perigynium oval; staminate spikes few-flowered; basal pistillate spikes on short, erect peduncles .... 68. *C. brainerdii.*
  - Perigynia strongly 2-keeled, otherwise nerveless.
    - Bract of lowest non-basal pistillate spike leaflet-like, exceeding culms, if at all colored, purplish-brown tinged at base.
      - Perigynia 2.5 to 3 mm. long, the beak 0.25 to 0.75 mm. long, shallowly bidentate .... 69. *C. brevipes.*
      - Perigynia 3 to 4.5 mm. long, the beak 0.75 to 1.50 mm. long, bidentate .... 70. *C. rossii.*
    - Bract of lowest non-basal pistillate spike squamiform and shorter than culm or, if longer, auriculate and strongly reddish-brown tinged at base .... 71. *C. brevicaulis.*

19. Digitatae.

Represented by one species in our range .... 72. *C. concinnoides.*

20. Bicolores.

- Perigynia short-tapering at apex, straw-colored, 2.5 to 3.75 mm. long; achenes strongly apiculate .... 73. *C. salinaeformis.*
- Perigynia rounded or truncate at apex, orange-colored or white pulverulent, smaller; achenes minutely apiculate.
  - Mature perigynia whitish, ellipsoidal, not fleshy or translucent, rather obscurely ribbed; scales appressed .... 74. *C. hassei.*
  - Mature perigynia orange or brownish, broader, fleshy or translucent, strongly ribbed; scales divaricate at maturity .... 75. *C. aurea.*

21. Paniceae.

- Perigynia beakless or nearly so; bract sheaths short; plant glaucous; leaf-blades narrow, involute .... 76. *C. livida.*
- Perigynia strongly beaked; bract sheaths long; plant not glaucous; leaf-blades broad, flat .... 77. *C. californica.*

22. Laxiflorae.

Represented by one species in our range .... 78. *C. hendersonii.*

23. Triquetrae.

- Lowest bract sheathless or very short-sheathing; perigynia glabrous, strongly ribbed or nerved.
  - Perigynia ovoid, 3.5 to 4.25 mm. long, abruptly short-beaked, the sides several-nerved. 79. *C. flaccifolia.*
  - Perigynia ovoid-lanceolate, 3.75 to 5 mm. long, tapering into the beak, the sides strongly ribbed .... 80. *C. whitneyi.*
- Lowest bract long-sheathing; perigynia hairy, faintly nerved or nerveless.
  - Leaf-blades hairy; spikes oblong or short-oblong, the upper approximate.
    - Perigynia 4 to 5 mm. long, round-tapering at base, finely many-nerved .... 81. *C. gynodynama.*
    - Perigynia 3.5 to 4 mm. long, tapering at base, 2-keeled, obscurely striate .... 82. *C. hirtissima.*
  - Leaf-blades not hairy; pistillate spikes linear, widely separate .... 83. *C. triquetra.*

24. Debiles.

Represented by one species in our range .... 84. *C. mendocinensis.*

25. Frigidae.

- Perigynia triangular or slightly flattened, the beak bidentulate; scales obtusish, the midvein not prominent at apex.
  - Spikes widely separate, the staminate one strongly overtopping the uppermost pistillate one; perigynia triangular, 3.5 mm. long or less .... 85. *C. lemmonii.*
  - Uppermost pistillate spikes bunched, little exceeded by the staminate one; perigynia compressed-triangular, longer.
    - Pistillate spikes oblong; scales reddish-brown .... 86. *C. luzulina.*
    - Pistillate spikes linear-oblong; scales dark-tinged .... 87. *C. ablata.*
- Perigynia strongly flattened, the beak bidentate; scales sharp-pointed with midvein prominent to apex.
  - Perigynia glabrous; scales smooth; bract sheaths strongly enlarged upward; leaf-blades very leathery .... 88. *C. luzulaefolia.*
  - Perigynia sparsely hairy; scales more or less hairy; bract sheaths scarcely enlarged upward; leaf-blades not leathery .... 89. *C. fissuricola.*

26. Anomalae.

Represented by one species in our range........ 90. *C. amplifolia.*

27. Atratae.

Terminal spike staminate or sometimes with perigynia in the middle.

Basal sheaths not filamentose.

Culms few-leaved, strongly aphyllopodic........ 91. *C. spectabilis.*

Culms many-leaved, clothed at base with dried-up leaves of previous year........ 92. *C. raynoldsii.*

Basal sheaths filamentose........ 93. *C. bifida.*

Terminal spike gynaecandrous; i.e., the terminal flowers pistillate.

Culms aphyllopodic, strongly purplish-red at base, the lower sheaths filamentose........ 94. *C. buxbaumii.*

Culms phyllopodic.

Spikes 3 to 5, not oblong-cylindric; perigynia walls not papery; perigynia 2.5 to 4.5 mm. long, nerveless or obscurely nerved on face, dull green to brownish-black.

Perigynia not papillate-roughened.

Spikes contiguous, sessile or nearly so, forming a dense head; scales lanceolate, strongly exceeding perigynia; culms stiff, erect........ 95. *C. helleri.*

Lower spike or spikes more or less peduncled, usually distant, erect or nodding; scales wider, shorter than or about equaling perigynia; culms more slender.

Scales with midvein largely obsolete; mature perigynia 3.5 to 4.5 mm. long, as wide or wider on either side than achene, the latter on stipe of nearly its own length; sheaths not purplish-tinged ventrally........ 96. *C. epapillosa.*

Scales with prominent midvein; mature perigynia 3.5 mm. long, narrower on either side than achene, the latter much longer than its stipe; sheaths normally purplish-tinged ventrally........ 97. *C. heteroneura.*

Perigynia papillate-roughened, especially on upper margins........ 98. *C. albo-nigra.*

Spikes 6 to 10, oblong-cylindric; perigynia 5 mm. long, lightly 3-nerved, light green, the walls papery; scales much shorter than perigynia........ 99. *C. mertensii.*

28. Acutae.

A. FLOWERING CULMS ARISING FROM THE CENTER OF PREVIOUS YEAR'S TUFT OF LEAVES AND SURROUNDED AT BASE WITH DRIED-UP LEAVES OF PREVIOUS YEAR.

1. *Lower sheaths of flowering culms not breaking and becoming filamentose.*

Strongly stoloniferous, the culms arising one to few together, low; lowest bract normally much shorter than inflorescence; scales with obsolete or slender midvein.

Dried first year leaf-blades at base of fertile culms stiff, rigid and conspicuous, concealing the culms; fertile culm leaves all blade bearing, the lower sheaths not purplish or hispidulous dorsally........ 100. *C. scopulorum.*

Dried first year leaf-blades at base of fertile culms much desiccated, not stiff, rigid or conspicuous, and not concealing the culms; lowest fertile culm leaves not blade-bearing, the lower sheaths purplish and more or less strongly hispidulous dorsally........ 101. *C. gymnoclada.*

Culms taller, less stiff, in larger clumps; lowest bract equaling or exceeding inflorescence; scales with slender midvein or broader light colored center.

Perigynia strongly nerved ventrally, the nerves raised.

Perigynia coriaceous, sessile or nearly so, the beak bidentate; strongly stoloniferous........ 102. *C. nebraskensis.*

Perigynia membranaceous, more or less slenderly stipitate, the beak entire; cespitose.

Perigynia substipitate, orbicular, minutely papillate-roughened; scales deciduous........ 103. *C. paucicostata.*

Peryginia strongly stipitate, ovate.

Perigynia yellowish-green, ribbed, papillate-roughened; scales deciduous........ 104. *C. hindsii.*

Perigynia light green or in age glaucous green, nerved, very minutely granular; scales long persistent........ 105. *C. kelloggii.*

Perigynia nerveless ventrally or with obscure impressed nerves.

Sheaths colored ventrally at mouth; lower pistillate spikes cernuous or subcernuous on long peduncles; scales in age whitened at tip........ 106. *C. sitchensis.*

Sheaths not colored ventrally at mouth; lower pistillate spikes not nodding; scales not whitened at tip........ 107. *C. aquatilis.*

2. *Lower or middle sheaths of flowering culms breaking and becoming filamentose.*

Beak of perigynium bidentate, hispidulous between teeth; scales strongly rough-awned........ 108. *C. barbarae.*

Beak of perigynium entire or emarginate, not hispidulous between teeth; scales not rough-awned.

Lower culm sheaths strongly yellowish-brown tinged, sharply keeled; culms stout, the leaf-blades 6 to 12 mm. wide..........109. *C. schottii.*

Lower culm sheaths purplish-tinged, not sharply keeled; culms more slender, the leaf-blades narrower..........110. *C. senta.*

B. SOME OR ALL OF THE FLOWERING CULMS ARISING LATERALLY AND NOT ENVELOPED AT BASE BY PREVIOUS YEAR'S TUFT OF LEAVES.

Culms very densely cespitose, forming dense stools; lowest sheaths strongly filamentose; lowest bract little developed, usually much exceeded by inflorescence..........111. *C. nudata.*

Culm much less densely cespitose, forming beds, conspicuously stoloniferous; lowest bract well-developed, from somewhat shorter than to exceeding inflorescence.

Perigynia orbicular or nearly so..........112. *C. eurycarpa.*

Perigynia oblanceolate..........113. *C. oxycarpa.*

29. Cryptocarpae.

Perigynia dull, straw-colored or light brown, slightly granular; lower sheaths of sterile shoots not filamentose..........114. *C. lyngbyei.*

Perigynia shining, brown, smooth; lower sheaths of sterile shoots strongly filamentose..........115. *C. obnupta.*

30. Trachychlaenae.

Represented by one species in our range..........116. *C. spissa.*

31. Hirtae.

Beak of perigynium obliquely cut, shallowly bidentate at maturity; foliage pubescent; staminate scales long-ciliate..........117. *C. yosemitana.*

Beak of perigynium deeply bidentate; staminate scales at most erose.

Foliage not pubescent; teeth of perigynium beak short.

Lowest bract strongly sheathing; fertile culms phyllopodic with many leaves, the sheaths not breaking and becoming filamentose..........118. *C. oregonensis.*

Lowest bract not sheathing; fertile culms aphyllopodic with few leaves, the sheaths breaking and becoming filamentose..........119. *C. lanuginosa.*

Sheaths and under surface of leaf-blades hairy; teeth of perigynium beak conspicuous..........120. *C. sheldonii.*

32. Extensae.

Represented by one species in our range..........121. *C. viridula.*

33. Physocarpae.

Perigynia ascending; lower sheaths more or less strongly filamentose; culms sharply triangular.

Perigynia 4 to 8 mm. long, abruptly contracted into beak..........122. *C. vesicaria.*

Perigynia 7 to 10 mm. long, tapering into beak..........123. *C. exsiccata.*

Perigynia spreading at maturity; lower sheaths not filamentose; culms bluntly triangular below spikes..........124. *C. rostrata.*

34. Pseudo-Cypereae.

Perigynia suborbicular in cross-section, more or less inflated; teeth of perigynium beak 0.5 to 1 mm. long..........125. *C. hystricina.*

Perigynia obtusely triangular, scarcely inflated, closely enveloping achene; teeth of perigynium beak 1.5 to 2 mm. long, recurved or spreading..........126. *C. comosa.*

Sect. 1. Inflatae Kük. Cespitose, the rootstocks elongate. Leaf-blades filiform. Spike solitary, ovoid, androgynous, densely flowered, bractless. Perigynia inflated, the walls very thin, slightly nerved, sessile, the smooth beak hyaline-tipped, obliquely cut, in age bidentulate. Achenes triangular. Stigmas 3.

1. **C. engelmannii** Bailey. Culms 5 to 20 cm. high; spike 10 to 15 mm. long, 6 to 10 mm. wide, the lower 3/4 pistillate; scales acute to cuspidate, all except lower shorter than perigynia; perigynia 4.5 to 5 mm. long, 2.25 mm. wide.

Alpine peaks or meadows, Sierra Nevada in Tulare Co. North to Washington, east to Colorado.

Locs.—Kaweah Peaks, *Dudley* 2215; Chagoopa Mdws., *Dudley* 2272.

Ref.—CAREX ENGELMANNII Bailey, Proc. Am. Acad. 22:132 (1886), type coll. by *Engelmann*, probably near Colorado Sprs., Colo.

2. **C. breweri** Boott. (Fig. 28.) Culms 1 to 2.5 dm. high; spike 1 to 2 cm. long, 6 to 10 mm. wide, the upper third staminate; scales ovate, short-acuminate, narrower and shorter than perigynia; perigynia 5 mm. long, 3.5 mm. wide.

High alpine peaks of the Sierra Nevada from Mt. Whitney to Mt. Shasta. North to Washington.

Locs.—Mt. Whitney, *Jepson* 1085; head of San Joaquin River, *Brewer* 2831; Mt. Dana, *Brewer* 1863; Mt. Shasta, *Jepson*.

Refs.—CAREX BREWERI Boott, Ill. Carex 4:142, pl. 455 (1867), type loc. Mt. Shasta, *Brewer* 1422; Mackenzie, Erythea 8:18, fig. 1 (1922); Kük. in Engler, Pflzr. 4^{20}:96, fig. 20H-K (1909).

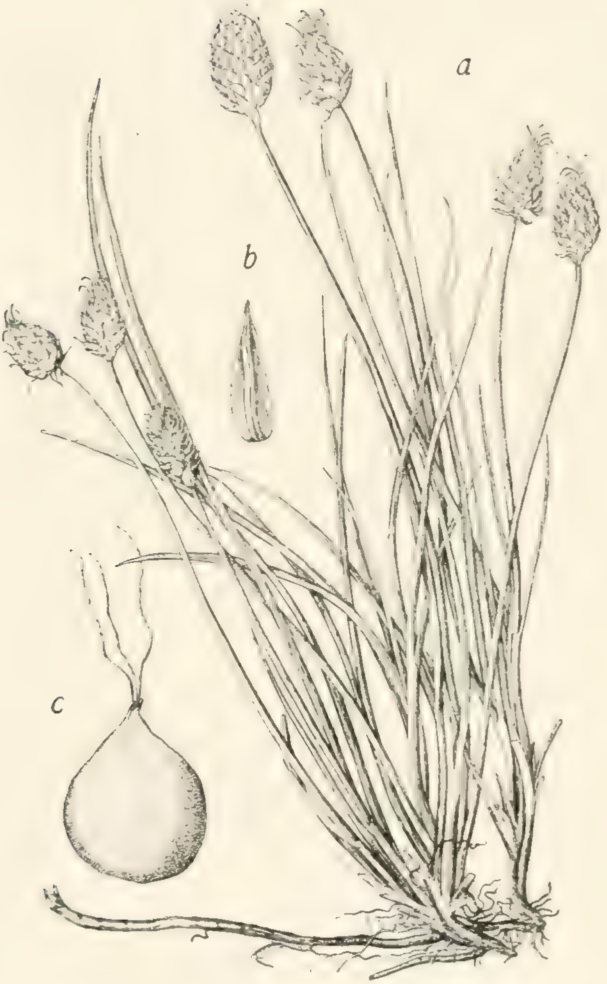

Fig. 28. CAREX BREWERI Boott. *a*, habit, × ⅔; *b*, scale, × 5; *c*, perigynium, × 5.

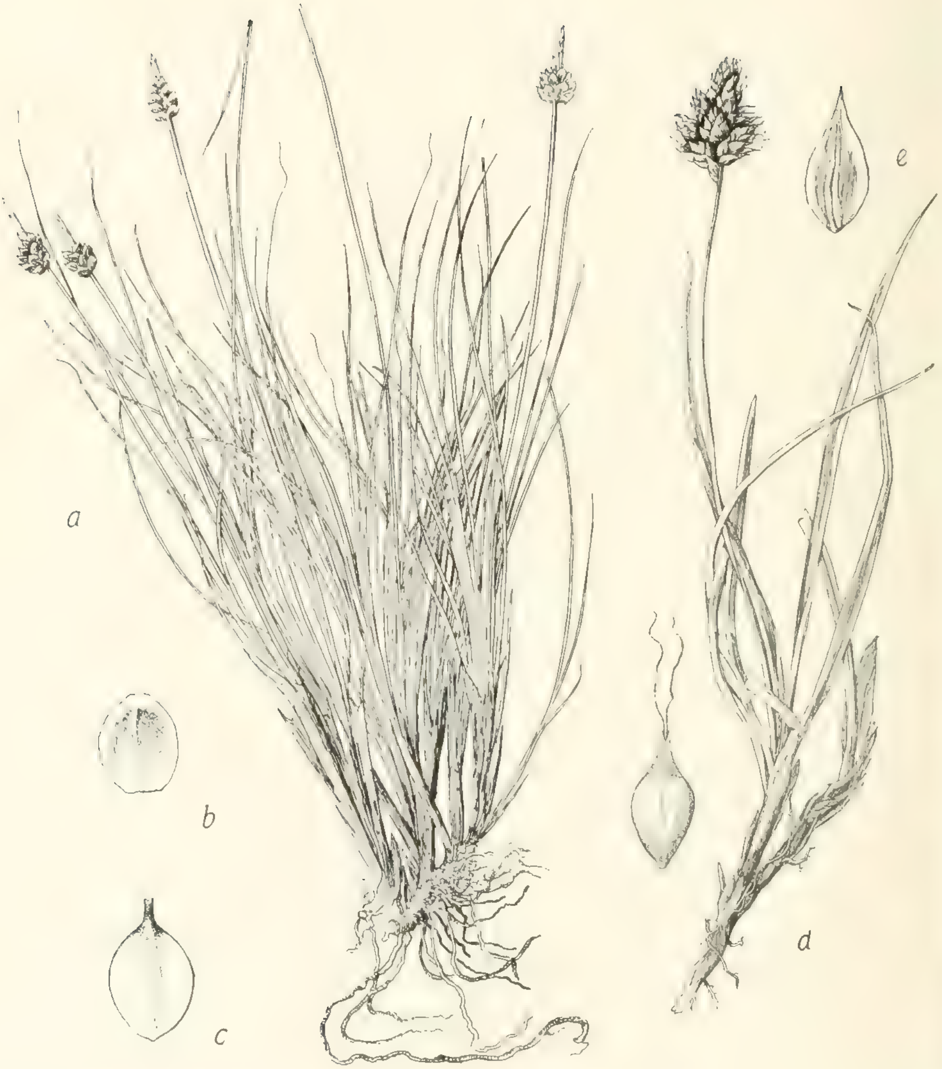

Fig. 29. *a*, Carex capitata L., habit, × 1; *b*, scale, × 8; *c*, perigynium, × 8. *d*, C. pansa Bailey, habit, × ⅔; *e*, scale, × 5; *f*, perigynium, × 5.

Sect. 2. Athrochlaenae Holm. Cespitose or with creeping rootstocks. Leaf-blades narrow. Spike solitary, androgynous, bractless, narrow, densely many-flowered. Pistillate scales soon falling. Perigynia slenderly strongly stipitate, widely spreading or the lower reflexed, obscurely triangular, nerveless, membranaceous, long-beaked, the beak obliquely cut, becoming bidentulate. Achenes usually triangular, slightly apiculate. Stigmas 3 or occasionally 2.

3. **C. nigricans** C. A. Mey. Culms 5 to 30 cm. high, stiff, firm, smooth; leaves 4 to 9 to a fertile culm, the blades 1.5 to 3 mm. wide, flat, or channeled at base; spike 8 to 15 mm. long, 6 to 9 mm. wide, the upper half staminate, the lower with 10 to 25 perigynia; scales ovate, obtuse to acutish, dark-brown tinged with hyaline margins, shorter than perigynia; perigynia 4 mm. long, brownish, tapering into a smooth beak.

Arctic alpine in the Sierra Nevada, from Tulare Co. to Eldorado Co. North to Alaska, east to Colorado.

Locs.—Mt. Silliman, *Dudley* 1503; Minarets, *Congdon;* Vogelsang Pass, *Jepson* 3230; Lake Lucille, *Brewer* 1379.

Refs.—CAREX NIGRICANS C. A. Mey. Mem. Acad. St. Petersb. 1:211, pl. 7 (1831), type from Unalaschka; Mackenzie, Erythea 8:22, fig. 2 (1922). *C. pyrenaica* W. Boott in Bot. Cal. 2:228 (1880), not Wahl.

Sect. 3. Capitatae Christ. Cespitose. Leaf-blades filiform. Spike solitary, ovoid, androgynous, densely flowered, bractless. Perigynia plano-convex, sharp-edged, not inflated, essentially nerveless, sessile, the walls thinnish, the smooth terete beak conspicuously hyaline-tipped, in age bidentulate. Achenes lenticular, apiculate. Stigmas 2.

4. **C. capitata** L. (Fig. 29a-c.) Culms 1 to 3.5 dm. high, roughish above, the basal sheaths purplish; spike 4 to 10 mm. long; scales ovate-orbicular, obtuse, shorter and narrower than perigynia, chestnut-brown with broad hyaline margins; perigynia 2 to 3 mm. long, pale green, smooth, rounded at base, the abrupt beak slender, dark-colored, less than 1 mm. long.

Sierra Nevada in Fresno and Tulare cos., 6500 to 8000 ft. North to Alaska, east to New Hampshire, south to Mexico.

Locs.—Mt. Goddard, *Hall & Chandler* 673; Kaweah Mdw., Tulare Co., *Dudley* 2216.

Refs.—CAREX CAPITATA L. Syst. Nat. ed. 10, 1261 (1759), type from n. Eur.; Kük. in Engler, Pflzr. 4^{20}:70, fig. 15K-N (1909); Mackenzie, Erythea 8:22, fig. 3 (1922).

Sect. 4. Foetidae Tuckerm. Leaf-blades narrow. Spikes few to several, androgynous, in a dense subglobose or ovoid head. Perigynia spreading, plano-convex, membraneous, usually obsoletely nerved, loosely enveloping the achene, rounded at base, stipitate, the beak obliquely cut, at times bidentulate. Achenes lenticular. Stigmas 2.

5. **C. vernacula** Bailey. Culms 0.5 to 2 dm. high, smooth; leaf-blades 2 to 4 mm. wide, stiff; head about 1 cm. in diameter, the staminate flowers inconspicuous; scales ovate, brown, sharp-pointed, rather wider and from shorter to longer than perigynia; perigynia ovoid, 3.5 to 4.5 mm. long, not margined, tapering into the smooth beak ⅓ length of body.

Alpine slopes, Sierra Nevada from Tulare Co. to Modoc Co. North to Washington, east to Colorado.

Locs.—Mt. Whitney, *Bailey* 2067; Mt. Goddard, *Hall & Chandler* 694; Stanislaus Peak, *A. L. Grant* 534; Big Trees, Calaveras Co., *Hillebrand* 2304; Butte Co., *R. M. Austin* 1159; Modoc Co., *Manning* 433.

Refs.—CAREX VERNACULA Bailey, Bull. Torr. Club 20:417 (1893), type from w. U. S.; Mackenzie, Erythea 8:23, fig. 4 (1922). *C. foetida* W. Boott in Bot. Cal. 2:232 (1880), not All. *C. incurva* Bailey, Contrib. U. S. Nat. Herb. 4:214 (1893), not Lightf.

Sect. 5. Divisae Christ. Culms arising singly or in small clumps at intervals, mostly stiff, dark-tinged at base, aphyllopodic. Leaf-blades narrow. Spikes few to many, ovoid or oblong, androgynous or dioecious, more or less closely aggregated into an oblong or oblong-ovoid head. Heads in some species dioecious or nearly so. Lower one to several bracts developed, short prolonged, the others bract-like. Perigynia appressed-ascending, plano-convex, smooth, often shining, coriaceous, more or less nerved on outer surface, sharp-edged but not wing-margined, rounded and spongy at base, the obliquely cut beak in age bidentulate. Achenes lenticular, closely enveloped. Stigmas 2.

6. **C. douglasii** Boott. Culms 6 to 30 cm. high; leaf-blades 1 to 2.5 mm. wide, involute above and flat or channeled at base; heads dioecious or nearly so; staminate spikes linear-elliptic, 8 to 15 mm. long, 2.5 to 4 mm. wide, the scales

straw-colored or brownish, pointed; pistillate spikes wider, the scales ovate to lanceolate, concealing the perigynia, yellowish-brown, with broad hyaline margins and lighter center; perigynia lanceolate, 4 mm. long, lightly nerved ventrally, strongly nerved dorsally, tapering into a strongly serrulate beak nearly 2 mm. long, its apex hyaline; styles elongate.

Dry or alkaline soil along or east of the Sierra Nevada from Modoc Co. to Inyo Co.; south to Mt. Pinos. North to British Columbia, east to Nebraska.

Locs.—Mt. Pinos, Ventura Co., *Hall* 6554; North Fork Crooked Creek, White Mts., *Jepson* 7271; Mono Valley, *Brewer* 1813; Yosemite, *Bolander* 6199; Donner Lake, *Davy* 3233 B; Warner Mts., *Griffiths & Hunter* 459.

Ref.—CAREX DOUGLASII Boott in Hook. Fl. Bor. Am. 2:213, pl. 214 (1840), type loc. Northwest Coast, *Douglas*.

7. **C. simulata** Mackenzie. Culms 3 to 5 dm. high; leaf-blades 2 to 4 mm. wide, flat; head linear-oblong or oblong-ovoid, 12 to 25 mm. long, the 5 to 15 spikes pistillate, staminate or androgynous; scales concealing the perigynia, cuspidate, brown with hyaline margins; perigynia broadly ovate, 1.8 to 2.25 mm. long, nerveless ventrally, serrulate above, abruptly beaked, the beak 0.25 mm. long.

Wet soil, west slope or mostly east slope of the Sierra Nevada from Fresno Co. to Sierra Co. and northward. North to Washington, east to Colorado.

Locs.—Kings River Cañon, *Dudley* 3193; Rowan Mdw., Fresno Co., *Dudley;* Sonora trail, *Brewer* 1865; Sierraville, *Dudley;* Modoc Co., *Manning* 952 (in part); Sisson, *Dudley*.

Refs.—CAREX SIMULATA Mackenzie, Bull. Torr. Club 34:604 (1907), type loc. Chug Creek, Albany Co., Wyo., *A. Nelson* 7316. *C. gayana* Boott, Ill. Car. 3:126, pl. 411 (1862), not Desv.

8. **C. pansa** Bailey. (Fig. 29d-f.) Culms 1.5 to 3 dm. high; leaf-blades 1 to 3 mm. wide; head 1.5 to 2.5 cm. long, the spikes lance-ovoid, 7 to 10 mm. long, the several to many perigynia appressed; scales with conspicuous white-hyaline margins, concealing perigynia; perigynia oblong-lanceolate, nerveless ventrally, tapering at apex, the beak 1 mm. long, serrulate.

Drifting sands along the seacoast from Monterey Co. to Del Norte Co. North to Washington.

Locs.—Asilomar, Monterey, *Parish* 11475; San Francisco, *Olsson-Seffer;* Eureka, *Tracy* 3258; Crescent City, *Dudley*.

Refs.—CAREX PANSA Bailey, Bot. Gaz. 13:82 (1880), based upon Clatsop, Ore., *Henderson*, and Ilwaco, Wash., *Henderson;* Mackenzie, Erythea 8:25, fig. 5 (1922).

9. **C. praegracilis** W. Boott. Culms 2 to 7.5 dm. high; leaf-blades 1.5 to 3 mm. wide, flattened or canaliculate; head 1 to 5 cm. long, the 5 to 15 spikes densely aggregated, androgynous, with 4 to 10 perigynia; scales ovate-lanceolate, acute to cuspidate, nearly concealing the perigynia; perigynia nerved on the outer, nearly nerveless on the inner face.

Meadows, widely distributed except on the higher mountains. North to Alaska, east to Iowa.

Locs.—San Jacinto Mts., *Hall* 2664; San Bernardino, *Parish* 4651; San Antonio Mts., *Abrams* 2679; San Pedro, *Wood* 262; Mt. Pinos, *Hall* 6375; Santa Barbara, *Bingham* 491; Pacific Grove, *Heller* 6634; Hepsedam Peak, San Benito Co., *Dudley;* San Francisco, *M. E. Jones* 3268; Sacramento, *Bolander* 4502; Giant Forest, *Dudley* 2987; Tallac, *Dudley;* Mill Creek, Mt. Lassen, *Hall & Babcock* 4308 in part; Hanaupah Cañon, Panamint Mts., *Jepson* 7097; White Mts., *Shockley* 632.

Refs.—CAREX PRAEGRACILIS W. Boott, Bot. Gaz. 9:87 (1884), type loc. San Diego, *Scott*. *C. marcida* Boott in Hook. Fl. Bor. Am. 2:212, pl. 213 (1840), type from Columbia River (not J. F. Gmel. 1791). *C. douglasii* Boott var. *brunnea* Olney, Bot. King 5:363 (1871), type from Cal., *Coulter* 805. *C. usta* Bailey, Mem. Torr. Club 1:20 (1889), based on *C. douglasii* var. *brunnea*. *C. hookeriana* Parish, Bull. S. Cal. Acad. 5:26 (1906), not Dew. *C. siccata* Parish, l.c. 50, not Dew.

Sect. 6. Muhlenbergianae Tuckerm. Densely cespitose. Culms not flattened. Spikes few, androgynous or pistillate but never gynaecandrous, rarely compound. Perigynia plano-convex, appressed to reflexed, often strongly spongy at base, narrowly sharp-margined, conspicuously beaked, the beak sharply bidentate. Achenes lenticular. Stigmas 2.

10. **C. hoodii** Boott. (Fig. 30a-c.) Culms 3 to 8 dm. high; leaf-blades 1.5 to 3.5 mm. wide; head 1 to 2 cm. long, the spikes with 5 to 10 ascending perigynia; scales ovate, sharp-pointed, chestnut brown with lighter keel and broad hyaline margins; perigynia lance-ovate, 4 to 5 mm. long, green-margined above, the beak ⅓ length of body.

Mountain meadows and slopes, Sierra Nevada from Tulare Co. to Shasta Co. North to British Columbia, east to Colorado.

Locs.—Soda Sprs., Tulare Co., *Dudley* 2343; Minarets, *Congdon;* Lake Merced, Yosemite Park, *Jepson* 4409, 4428; Kennedy Lake, *A. L. Grant* 199; Tallac, *Brainerd;* Morgan, Tehama Co., *Hall & Babcock* 4346.

Refs.—CAREX HOODII Boott in Hook. Fl. Bor. Am. 2:211, pl. 211 (1840), type loc. Columbia River, *Douglas;* Mackenzie, Erythea 8:26, fig. 6 (1922). *C. hoodii* Boott var. *nervosa* Bailey, Mem. Torr. Club 1:14 (1889), type from Cal., *Kellogg & Harford* 1069.

11. **C. tumulicola** Mackenzie. Culms 2 to 8 dm. high; leaf-blades 1.5 to 2.5 mm. wide; head 2 to 5 cm. long, slender, the upper spikes aggregated, the lower separate, with 10 or fewer appressed perigynia; lower bracts long-cuspidate; scales largely concealing perigynia, brownish straw-color with hyaline margin and green midrib, acuminate to cuspidate; perigynia lanceolate, 4 to 5 mm. long, the serrulate beak ⅓ to ½ length of body.

Dry soil in the coastal counties from Monterey Co. to Humboldt Co., and in the Sierra Nevada from Tuolumne Co. to Calaveras Co. North to Washington.

Locs.—Coast Ranges: Monterey, *Davy* 7268; Santa Cruz Mts., *Bolander* 150; Berkeley Hills, *Davy* 4244; St. Helena, *Jepson* 6242; Ft. Bragg, *Bolander* 4765; Eureka, *Tracy* 4642. Sierra Nevada: Relief Dam, Tuolumne Co., *A. L. Grant* 370; Calaveras Big Trees, *A. L. Grant* 4c.

Refs.—CAREX TUMULICOLA Mackenzie, Bull. Torr. Club 34:154 (1907), type loc. Lake Temescal, Alameda Co., *Bioletti;* Erythea 8:27, fig. 7 (1922). *C. muricata* L. var. *gracilis* W. Boott in Bot. Cal. 2:232 (1880), not F. Boott. *C. hookeriana* Kük. in Engler. Pflzr. 4^{20}:161 (1909) as to Cal. plant, not Dew.

Sect. 7. Multiflorae Kunth. Densely cespitose. Culms sharply triangular. Opaque part of sheaths usually transversely rugulose, red-dotted. Spikes numerous, small, androgynous or pistillate, but never gynaecandrous, the lower more or less compound. Bracts frequently conspicuous. Perigynia plano-convex, appressed-ascending or spreading, not thick-walled, somewhat spongy at base, short-stipitate, sharp-margined, more or less nerved, conspicuously rough-beaked, the beak bidentate. Achenes lenticular. Stigmas 2.

12. **C. stenoptera** Mackenzie. Culms 2.5 to 4 dm. high; leaf-blades 2 to 3 mm. wide, channeled, the sheaths tight; head decompound, 2 to 5.5 cm. long, with spikes 5 to 8 mm. long, 4 to 6 mm. wide; bracts inconspicuous; scales ovate-lanceolate, obtusish to short-cuspidate, brownish, exceeding perigynia; perigynia 3 to 3.5 mm. long, nerved dorsally, nerveless ventrally or nearly so, round-tapering at base, tapering into a serrulate beak about ½ length of body.

San Antonio Mts., Southern California.

Ref.—CAREX STENOPTERA Mackenzie, Erythea 8:28 (1922), type loc. Ice House Cañon, San Antonio Mts., *Johnston* 1505.

13. **C. alma** Bailey. (Fig. 30d-f.) Culms 3 to 12 dm. high, strict, rough on angles; leaf-blades 3 to 6 mm. wide; head 2.5 to 20 cm. long, decompound, the clusters closely aggregated to strongly separate; scales ovate, short-pointed to obtusish, straw-colored or brownish; perigynia 3.5 to 4 mm. long, smooth, shining, narrowly green-margined, serrulate from middle, lightly few-nerved on both sides, tapering into the serrulate beak.

Along streams, Monterey and Tulare cos. to Southern California. East to southern Nevada and Arizona.

Locs.—Coast Ranges: Tassajara Hot Sprs., Monterey Co., *Elmer* 3137; Mt. Pinos, *Hall* 6429. Southern California: Pasadena, *McClatchie;* San Antonio Mts., *Johnston* 1425; Mt. San Gorgonio, *Geo. B. Grant* 6399; Palm Sprs., Mt. San Jacinto, *Parish* 4144; New York Mts., *Parish* 10225. Sierra Nevada: Nelson Soda Sprs., Tulare Co., *Dudley* 877; Bisses sta., Kern Co., *Dudley* 405.

Refs.—CAREX ALMA Bailey, Mem. Torr. Club 1:50 (1889), type loc. San Bernardino Co., *Parry & Lemmon* 396; Mackenzie, Erythea 8:28, fig. 8 (1922). *C. vitrea* Holm, Am. Jour.

Sci. ser. 4, 17:302, figs. 5-7 (1904), type from Palm Sprs., Mt. San Jacinto, *Parish* 4144. *C. chrysoleuca* Parish, Bull. S. Cal. Acad. 5:22 (1906), not C. chrysoleuca Holm.

14. **C. densa** Bailey. (Fig. 30g-i.) Culms 3 to 6 dm. high, smooth or roughened above, from exceeding to shorter than the leaves; leaf-blades 3 to 6 mm. wide, the sheaths septate dorsally, and thin, hyaline and more or less cross-rugulose ventrally, prolonged and convex at the mouth; head 2 to 5 cm. long; bracts inconspicuous, except 1 or 2 lower ones; perigynia 3.5 to 4.5 mm. long, strongly convex dorsally, ovate or ovate-lanceolate from a round-tapering base, narrowly green-margined, serrulate above middle, the beak more than ½ length of body.

Dry soil, cismontane: Sierra Nevada from Mariposa Co. northward; Marysville Buttes; Coast Ranges from Santa Clara Co. northward. North to Oregon.

Locs.—Sierra Nevada: Snow Creek, Mariposa Co., *Congdon;* Pine Grove, Amador Co., *Hansen* 1233. Coast Ranges: Santa Cruz Mts., *J. R. Bush;* Crystal Sprs., San Mateo Co., *Abrams* 2444; Oakland, *Bolander* 6204; Calistoga, *Tracy* 1637; Sherwood Valley, *Davy* 5150; Buck Mt., Humboldt Co., *Tracy* 4231; Weaverville, *Yates* 296; Sisson, *Jepson* 51a.

Refs.—CAREX DENSA Bailey, Mem. Torr. Club 1:50 (1889), type loc. Mark West Creek, Sonoma Co., *Bigelow;* Mackenzie, Erythea 8:29, fig. 9 (1922). *C. brongniartii* Kunth, var. *densa* Bailey, Proc. Am. Acad. 22:137 (1886). *C. brongniartii* Boott, Ill. Car. 3:124, pl. 402 (1862), in part, not Kunth. *C. chrysoleuca* Holm, Am. Jour. Sci. ser. 4, 17:302 (1904), type from Mariposa, *Congdon*. *C. disticha* W. Boott in Bot. Cal. 2:230 (1880), not Huds. *C. glomerata* W. Boott, l.c. 232, not Thunb. *C. paniculata* W. Boott, l.c. 232 in part, not L.

15. **C. vicaria** Bailey. Culms 3 to 6 dm. high, exceeding the leaves, rough above; leaf-blades 3 to 4.5 mm. wide, the sheaths tight, not conspicuously septate dorsally, thin-hyaline and more or less cross-rugulose ventrally, short-prolonged and convex at mouth; head 1.5 to 3 cm. long; bracts inconspicuous except 1 or 2 lower ones; perigynia 3 to 3.5 mm. long, ovate from a rounded base, green-margined, serrulate above middle, the beak ½ length of body.

Marshes, Mendocino Co. (Round Valley, Chesnut 108). North to Washington.

Refs.—CAREX VICARIA Bailey, Mem. Torr. Club 1:49 (1889), type from Ore., *E. Hall.* *C. brongniartii* Bailey, Proc. Am. Acad. 22:137 (1886), not Kunth.

16. **C. breviligulata** Mackenzie. Culms 3 to 6 dm. high, exceeding leaves, rough above; leaf-blades 3 to 4.5 mm. wide, the sheaths tight, not conspicuously septate dorsally, thin-hyaline and more or less cross-rugulose ventrally, truncate at mouth; head 1.5 to 3.5 cm. long; bracts usually not conspicuous; perigynia 3.25 to 3.75 mm. long, ovate from a round-tapering base, green-margined, serrulate from middle, the beak ½ length of body.

Marshes and swales: North Coast Ranges; Sierra Nevada. North to Oregon.

Locs.—Santa Rosa, *Wooton;* Round Valley, ne. Mendocino Co., *Chesnut* 285; Susanville, *Jones;* North Fork, Fresno Co., *Griffiths* 4479.

Refs.—CAREX BREVILIGULATA Mackenzie, Erythea 8:92 (1922). *C. vicaria* var. *costata* Bailey, Mem. Torr. Club 1:49 (1889), type from Grant's Pass, Ore., *Henderson* 1477.

17. **C. dudleyi** Mackenzie. Culms 3 to 7 dm. high, rough above, exceeding leaves; leaf-blades 4 to 7 mm. wide, the sheaths tight, inconspicuously septate dorsally, white-hyaline and scarcely cross-rugulose ventrally, the ligule as long as wide; head 2 to 3.5 cm. long; bracts setaceous, the lower conspicuous; perigynia narrowly ovate from a rounded base, brownish-yellow with green margin, nerved ventrally, the beak serrulate.

Coast Ranges from Monterey Co. to Lake Co. Apparently local.

Locs.—Glen Ellen, Sonoma Co., *Bioletti* 19; Scott Valley, Lake Co., *Blankinship.*

Ref.—CAREX DUDLEYI Mackenzie, Erythea 8:30 (1922), type loc. Tassajara Hot Sprs., Monterey Co., *Elmer* 2132.

Sect. 8. Paniculatae Kunth. Densely or loosely cespitose. Culms not flattened. Opaque part of leaf-sheaths strongly red-dotted. Spikes numerous, small, androgynous or pistillate, but never gynaecandrous, the lower compound or decompound. Bracts usually inconspicuous. Perigynia thick, high convex on the dorsal and often somewhat convex on the ventral face, ascending or spreading, coriaceous, spongy at base, stipitate, narrowly margined, more or less nerved, conspicuously rough-beaked, the beak bidentate. Achenes lenticular. Stigmas 2.

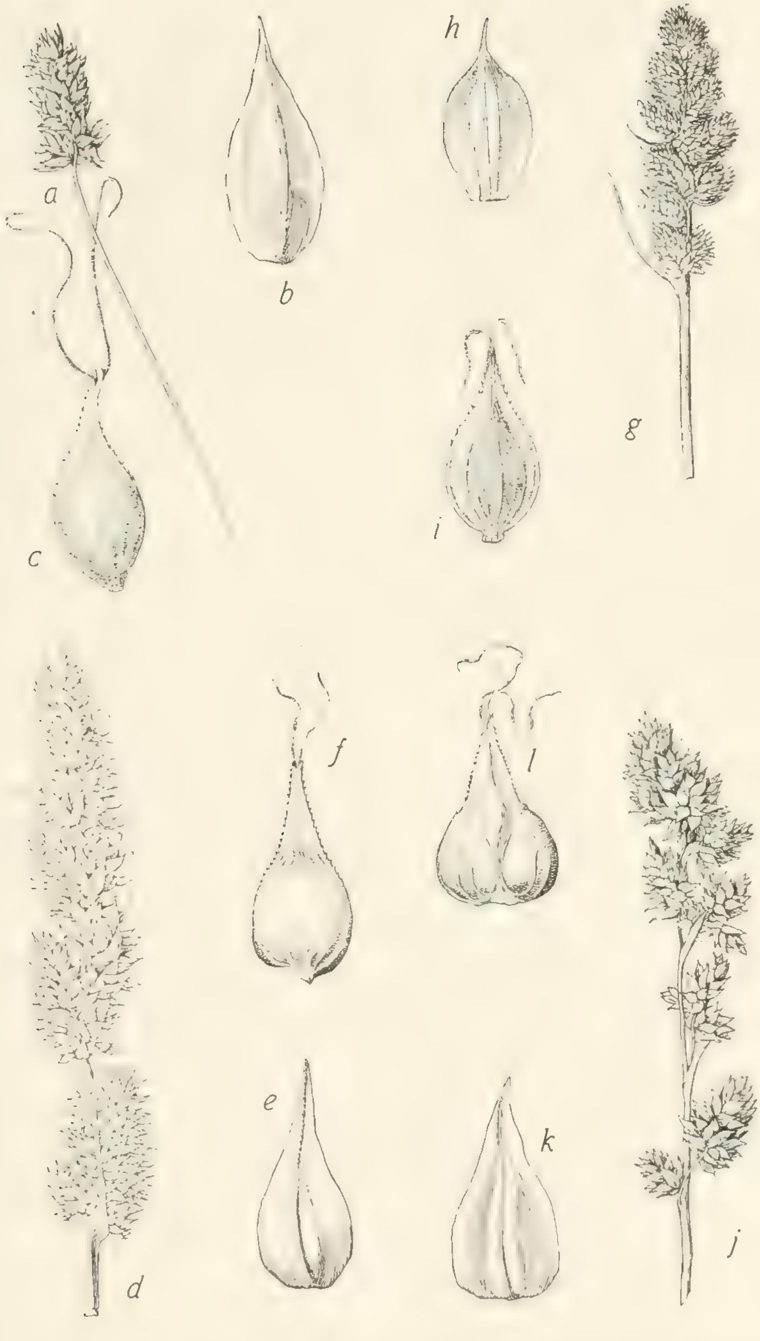

Fig. 30. *a*, Carex hoodii Boott, inflorescence, × 1; *b*, scale, × 7; *c*, perigynium, × 7. *d*, C. alma Bailey, inflorescence, × 1; *e*, scale, × 8; *f*, perigynium, × 8. *g*, C. densa Bailey, inflorescence, × 1; *h*, scale, × 6; *i*, perigynium, × 6. *j*, C. cusickii Mackenzie, inflorescence, × 1; *k*, scale, × 8; *l*, perigynium, × 8.

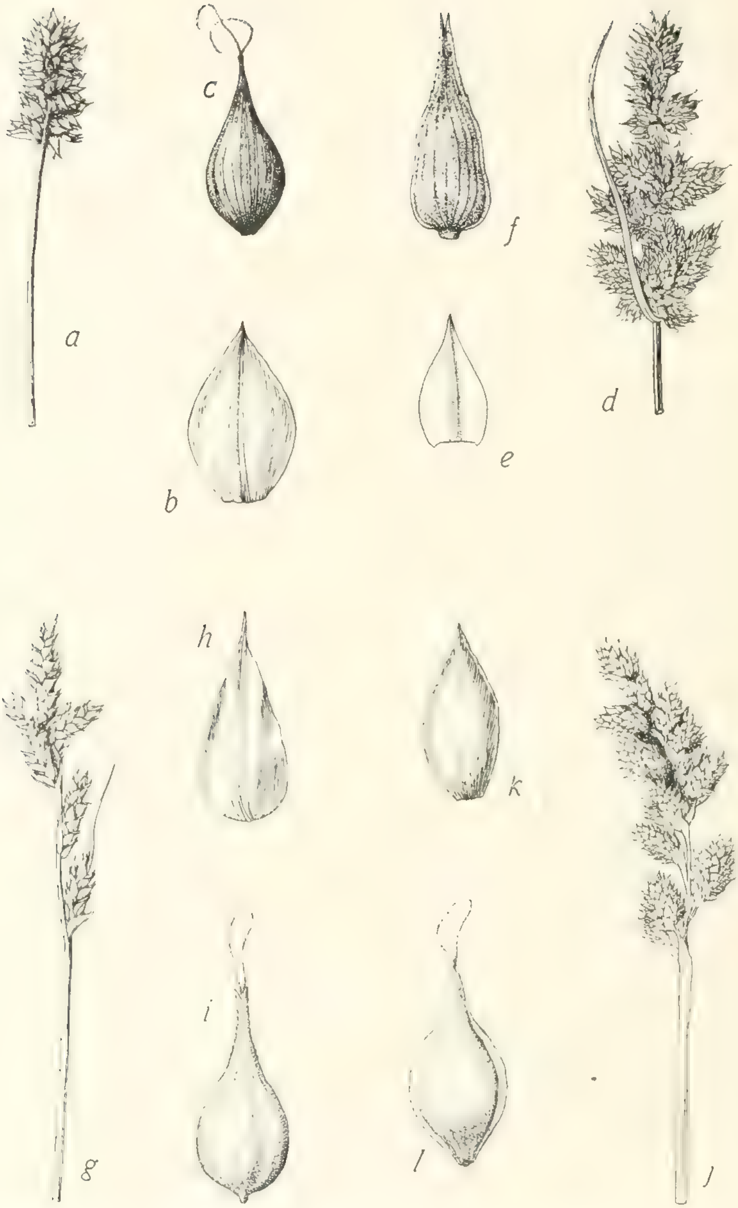

Fig. 31. *a*, Carex nervina Bailey, inflorescence, × 1; *b*, scale, × 6; *c*, perigynium, × 6. *d*, C. stipata Muhl., inflorescence, × 1; *e*, scale, × 6; *f*, perigynium, × 6. *g*, C. bolanderi Olney, inflorescence, × 1; *h*, scale, × 7; *i*, perigynium, × 7. *j*, C. feta Bailey, inflorescence, × 1; *k*, scale, × 8; *l*, perigynium, × 8.

18. **C. diandra** Schrank. Culms 3 to 7 dm. high, slender; leaf-blades canaliculate at base; sheaths not copper-colored at mouth; head 2.5 to 5 cm. long; scales acute, brownish; perigynia round-truncate at base, the beak serrulate.

Wet meadows, very local: San Bernardino Valley and Oriole Lake, Tulare Co. North to Alaska, east to Newfoundland.

Refs.—CAREX DIANDRA Schrank, Acta Acad. Mogunt. 49 (1782), type from s. Bavaria, Germany; Kük. in Engler, Pflzr. 4^{20}:175, fig. 28A-D (1909). *C. bernardina* Parish, Bull. S. Cal. Acad. 5:24, pl. 21 (1906), type loc. San Bernardino Valley, *Parish* 4600.

19. **C. cusickii** Mackenzie. (Fig. 30j-l.) Culms stout, 7 to 12 dm. high; leaf-blades flat with slightly revolute margins, the sheaths copper-tinged at mouth; head 4 to 8 cm. long; scales chestnut-tinged; perigynia truncate at base, the beak setulose-serrulate.

Wet meadows near the coast from San Francisco to Del Norte Co. Rare. North to British Columbia, east to Montana.

Locs.—San Francisco, *Bolander* 1568 (in part); Crescent City, *Dudley*.

Refs.—CAREX CUSICKII Mackenzie in Piper & Beattie, Fl. Nw. Coast 72 (1915); Erythea 8:31, fig. 10 (1922). *C. teretiuscula* Good. var. *ampla* Bailey, Mem. Torr. Club 1:53 (1889), type from Burnt River, Ore., *Cusick* 1331. *C. paniculata* W. Boott in Bot. Cal. 2:232 (1880) in part, not L.

Sect. 9. Stenorhynchae Holm. Densely cespitose or with more or less elongated rootstocks. Culms triangular or somewhat flattened. Opaque part of leaf-sheaths usually transversely rugulose or red-dotted. Spikes few to many, androgynous or pistillate, but never gynaecandrous, the lower simple to compound. Bracts little developed. Perigynia plano-convex, yellowish or yellowish-brown, appressed-ascending to spreading, not thick-walled but strongly spongy at base, stipitate, strongly many-nerved, the margins nearly obsolete on the lower half, conspicuously beaked, the beak bidentate. Achenes lenticular. Stigmas 2.

20. **C. jonesii** Bailey. Culms 2 to 6 dm. high, slender; leaf-blades 1 to 2 mm. wide; opaque part of sheath white, not cross-rugulose, truncate at mouth; head 8 to 18 mm. long, the larger spikes with 5 to 10 ascending perigynia; scales exceeding or shorter than the perigynia, ovate, dark brown; perigynia ovate-lanceolate, 3 to 4 mm. long, 1.5 mm. wide, the beak very slightly serrulate, $\frac{1}{3}$ length of body.

High mountains, 5000 to 7200 ft.: San Bernardino Mts.; Sierra Nevada from Tulare Co. to Siskiyou Co. North to Washington, east to Montana.

Locs.—Bluff Lake, San Bernardino Mts., *Parish* 3273; Kaweah Mdw., *Dudley* 2207; Kings River Cañon, *Dudley* 3191; Peregoy Mdw., Yosemite Park, *Jepson* 4335; Sonora Peak, *A. L. Grant* 412; Truckee River, *Davy;* Mt. Shasta, *Goldsmith* 37.

Refs.—CAREX JONESII Bailey, Mem. Torr. Club 1:16 (1889), type loc. Soda Sprs., Nevada Co., *Jones;* Mackenzie, Erythea 8:32, fig. 11 (1922). *C. illota* Parish, Bull. S. Cal. Acad. 5:52 (1906), not Bailey. *C. bonplandii* Kunth. var. *angustifolia* W. Boott in Bot. Cal. 2:233 (1880) as to spms. with androgynous spikes, not F. Boott.

21. **C. nervina** Bailey. (Fig. 31a-c.) Culms 3 to 9 dm. high, strongly aphyllopodic, slightly flattened in drying; opaque part of sheaths olive-tinged, truncate or concave at the mouth; head 1.5 to 3 cm. long, the larger with 6 to 12 ascending perigynia, the staminate flowers rarely conspicuous; scales ovate, brownish; perigynia ovate-lanceolate, 3.5 to 4 mm. long, the beak smoothish, 1 mm. long, the teeth erect.

High mountains, 4000 to 7000 ft., Sierra Nevada from Tulare Co. to Siskiyou Co. North to southern Oregon.

Locs.—Giant Forest, *Dudley* 2998; Lake Tenaya, *Congdon;* Emigrant Gap, *M. E. Jones* 3533; Craggy Peak, Siskiyou Co., *Dudley*.

Refs.—CAREX NERVINA Bailey, Bot. Gaz. 10:203, pl. 3, figs. 6–8 (1885), type loc. Summit Camp, Placer Co., *Kellogg;* Mackenzie, Erythea 8:33, fig. 12 (1922); not C. nervina Parish, Bull. S. Cal. Acad. 5:26 (1906).

22. **C. stipata** Muhl. (Fig. 31d-f.) Culms 3 to 12 dm. high, rather weak, sharply triangular, strongly serrulate above; leaf-blades 4 to 8 mm. wide, flat, flaccid, the sheaths strongly septate dorsally, the opaque part thin, quickly broken, cross-rugulose; head 3 to 10 cm. long, yellowish-brown; scales ovate-

triangular, light-brownish, about length of body of perigynium; perigynia lanceolate, 4 to 5 mm. long, the serrulate beak longer than or nearly equaling the body.

Swamps and wet meadows: Coast Ranges from Sonoma Co. to Siskiyou Co., thence southerly in the Sierra Nevada to Sierra Co. North to Alaska, east to Newfoundland.

Locs.—North Coast Ranges: Santa Rosa, *Heller;* Weaverville, *Yates* 295; Sisson, *Jepson* 56a. Sierra Nevada: Sierra Valley, *Lemmon* 479; Quincy, *Jepson* 4148.

Refs.—CAREX STIPATA Muhl. Willd. Sp. Pl. 4:233 (1805), type from Penn., *Muhlenberg;* Kük. in Engler, Pflzr. 4^{20}:172, fig. 27H-L (1909); Mackenzie, Erythea 8:33, fig. 13 (1922).

Sect. 10. Stellulatae Kunth. Densely cespitose. Culms triangular. Sheaths not red-dotted or cross-rugulose. Spikes 2 to 10, or by reduction 1, gynaecandrous, pistillate or in a few species staminate, not compound. Bracts inconspicuous. Perigynia plano-convex, yellow-brown or brown, spreading or reflexed at maturity, the body orbicular, ovate or broadly oval, strongly spongy at base, sharp-edged nearly if not entirely to the rounded or truncate base, not puncticulate, nerved on the outer, nerved or nerveless on the inner surface, the beak bidentate or obliquely cut. Achenes lenticular. Stigmas 2.

23. **C. laeviculmis** Meinsh. Culms 3 to 7 dm. high, weak; leaf-blades 1 to 2 mm. wide, light green, flat, soft; spikes 3 to 8, widely separate or upper approximate, suborbicular, 3 to 10 mm. long, with 3 to 10 perigynia; uppermost spike long-clavate at base; scales ovate, about length of body of perigynium, with conspicuous green midvein; perigynia green or brownish-green, oblong-ovoid, plano- or concave-convex, 2.5 to 4 mm. long, 1.5 mm. wide, thin-walled, lightly nerved ventrally, the beak $\frac{1}{3}$ length of body.

Wet shaded places: Humboldt Co.; northern Sierra Nevada from Eldorado Co. to Butte Co. Northerly to Alaska and Idaho.

Locs.—Bald Mt., Humboldt Co., *Tracy* 4524; Stirling, Butte Co., *Heller* 10819; Strawberry Creek, Eldorado Co., *Brainerd* 170.

Refs.—CAREX LAEVICULMIS Meinsh. Bot. Centralb. 55:195 (1893), type from Kamtschatka; Kük. in Engler, Pflzr. 4^{20}:232, fig. 37E F (1909); Mackenzie, Erythea 8:34, fig. 14 (1922).

24. **C. interior** Bailey. Culms 1.5 to 5 dm. high, slender and wiry; leaf-blades 1 to 3 mm. wide, flat or somewhat canaliculate; head 1 to 2 cm. long, the 3 or 4 spikes approximate, the lateral pistillate, suborbicular, 4 mm. long, with 3 to 10 widely spreading perigynia, the upper long-tapering and staminate at base; scales ovate-orbicular, brownish, hyaline-margined all around, the center lighter-colored, the midvein not sharply defined; perigynia oblong-ovoid, straw-color or light-brownish, plump, 2.5 to 3 mm. long, sparingly serrulate on the upper margins, abruptly beaked, the beak with very short teeth.

Boggy meadows, northern Sierra Nevada from Plumas Co. to Siskiyou Co. North to British Columbia, east to Newfoundland, and south to Mexico.

Locs.—Prattville, Plumas Co., *Jones;* Mt. Shasta, *A. Wood* 999.

Ref.—CAREX INTERIOR Bailey, Bull. Torr. Club 20:426 (1893), type loc. Penn Yan, New York, *Sartwell.*

25. **C. ormantha** Mackenzie. Culms 1.5 to 4 dm. high, slender but rather stiff; leaf-blades slightly canaliculate, 1.5 to 2 mm. wide; head 2 to 6 cm. long; spikes 3 or 4, the lateral suborbicular, 6 to 8 mm. wide, with 2 to 12 widely radiating perigynia; perigynia rounded at base, tapering into the bidentate beak more than $\frac{1}{2}$ length of body, the teeth short.

Boggy places in the mountains, mostly 4000 to 6000 ft.: San Bernardino Mts.; Sierra Nevada from Tulare Co. to Tehama Co. Also in Oregon.

Locs.—San Bernardino Mts., *Parish* 3274; Kaweah River, *Dudley* 1448; Crescent Lake, Mariposa Co., *Congdon;* Yosemite, *Hall & Babcock* 3412; Calaveras Big Trees, *Bolander & Hillebrand* 2324; Mineral, Tehama Co., *Eggleston* 7209.

Refs.—CAREX ORMANTHA Mackenzie, Erythea 8:35 (1922). *C. echinata* Murr. var. *ormantha* Fern. Proc. Am. Acad. 37:483, pl. 4, f. 89 (1902), type loc. Strawberry Creek, Eldorado Co., *Brainerd* 160, excluding Conn. and R. I. spms. *C. stellulata* Good. var. *ormantha* Fern. Rhod. 4:222 (1902).

26. **C. phyllomanica** W. Boott. Culms 2.5 to 6 dm. high, smooth or nearly so; leaf-blades flat, 1.75 to 2.75 mm. wide; head 1.5 to 3.5 cm. long; spikes 3 or 4, the lateral suborbicular, 7 mm. wide with 8 to 15 widely spreading perigynia;

perigynia round-truncate at base, tapering into a beak scarcely ½ length of body, the teeth short.

Swampy places near the coast from Mendocino Co. to Del Norte Co. North to Alaska.

Locs.—Mendocino City, *Bolander* 4746; Patricks Point, Humboldt Co., *Tracy* 4364; Del Norte Co., *Davy*.

Refs.—CAREX PHYLLOMANICA W. Boott in Bot. Cal. 2:233 (1880), type loc. Mendocino City, *Bolander* 4746. *C. sterilis* W. Boott, l.c. 236, not Willd. *C. vallicola* W. Boott, l.c. 235, not Dew. *C. echinata* W. Boott, l.c. 237, not Murr.

27. **C. angustior** Mackenzie. Culms very slender but strict, 1 to 6 dm. high, somewhat roughened above; leaf-blades 1 to 2 mm. wide, flat or canaliculate; spikes 2 to 5, approximate, 4 to 6 mm. long, with 3 to 15 perigynia, the terminal long-clavate, the lateral rounded at base; scales as long as body of perigynia, ovate; perigynia 2.5 to 3.5 mm. long, yellowish-brown, impressed-nerved ventrally, tapering into a bidentate beak more than ½ length of body.

Boggy places, rare: Eldorado Co.; Humboldt Co. North to Washington, east to Newfoundland.

Locs.—Fallen Leaf Lake, *Abrams* 4796; Bald Mt., Humboldt Co., *Tracy* 4532.

Refs.—CAREX ANGUSTIOR Mackenzie in Rydb. Fl. Rocky Mts. 124 (1917). *C. stellulata* Good. var. *angustata* Carey, Gray's Man. 544 (1848), type loc. Fairfield, N. Y.

28. **C. illota** Bailey. Culms 1 to 3.5 dm. high, slender but strict; leaf-blades 1.5 to 3 mm. wide; scales broadly ovate, obtuse, brownish-black; perigynia ovate, 3 mm. long, obscurely nerved, brownish-black, the beak ⅓ length of body, smooth or nearly so, emarginate.

High montane, Sierra Nevada from Tulare Co. to Eldorado Co. North to Washington, east to Colorado.

Locs.—Camp Alta, Tulare Co., *Dudley* 992; Kings River. *Dudley* 3299; Soda Sprs. of the San Joaquin, *Congdon*; Yosemite, *Congdon* 88; Devils Basin and Lake Audrain, Eldorado Co., *Brainerd*.

Refs.—CAREX ILLOTA Bailey, Mem. Torr. Club 1:15 (1889), not Parish, Bull. S. Cal. Acad. 5:52 (1906). *C. bonplandii* Kunth var. *minor* Boott, Proc. Acad. Phila. 77 (1863), type from Col., *Hall & Harbour*. *C. bonplandii* Kunth var. *angustifolia* W. Boott in Bot. Cal. 2:233 (1880), mostly, not F. Boott.

Sect. 11. Deweyanae Tuckerm. Densely cespitose. Culms triangular. Sheaths not red-dotted or cross-rugulose. Spikes 3 to 8, gynaecandrous, pistillate or rarely staminate, simple. Lower one or two bracts often conspicuous. Perigynia plano-convex, light or yellowish-green, appressed, the body ovate or linear-oblong, strongly spongy at base, only upper half sharp edged, round-tapering at base, nerved on the outer face, nerved or nerveless on the inner face, the beak bidentulate to deeply bidentate. Achenes lenticular. Stigmas 2.

29. **C. leptopoda** Mackenzie. Culms erect, 2 to 8 dm. high, roughened beneath head; leaf-blades 2.5 to 5 mm. wide; spikes ovoid-oblong or linear-oblong, with 6 to 18 perigynia; scales not reddish-brown tinged, mostly cuspidate, shorter than the bodies of the ovate-lanceolate perigynia.

Damp woods: Sierra Nevada from Tulare Co. to Shasta Co., 4000 to 8000 ft.; Coast Ranges from Santa Cruz Co. to Trinity Co., 50 to 3000 ft. North to British Columbia, east to Idaho.

Locs.—Sierra Nevada: Mineral King, *Hall & Babcock* 5373; Pine Ridge, Fresno Co., *Hall & Chandler* 238 (in part); Yosemite, *Bolander* 6201; San Antonio Creek, Calaveras Co., *Dudley*; McCloud, *Goldsmith* 8. Coast Ranges: Redwood Park, Santa Cruz Co., *Dudley*; Oakland Hills, *Bolander*; Sherwood Valley, *Dudley*; Eureka, *Tracy* 921; Coffee Creek, Trinity Co., *Goldsmith* 18.

Refs.—CAREX LEPTOPODA Mackenzie, Rydb. Fl. Rocky Mts. 124 (1917), type loc. Elk Rock, near Oswego, Clackamas Co., Ore., *Heller* 10052. *C. deweyana* W. Boott in Bot. Cal. 2:236 (1880) in part, not Schw.

30. **C. bolanderi** Olney. (Fig. 31g-i.) Culms 1.5 to 9 dm. high, little roughened beneath head; leaf-blades 2.5 to 5 mm. wide; spikes linear-oblong or linear, with 8 to 30 perigynia; scales usually reddish-brown tinged, mostly acute or mucronate, concealing the bodies of the lanceolate perigynia.

Widely distributed in the mountain ranges, mostly at lower altitudes, 100 to 2000 (or 6000) ft.: San Bernardino Mts.; Coast Ranges; Sierra Nevada. North to British Columbia, east to New Mexico and Montana.

Locs.—Waterman Cañon, San Bernardino Mts., *Parish* 2486. Coast Ranges: Lucia, *Hall* 9992; Santa Cruz, *Bolander;* Mt. Tamalpais, *Heller* 5715; Napa Valley, *Bigelow;* Comptche, *McMurphy* 430; Eureka, *Abrams* 6219; Mt. Shasta, *Jepson* 54a. Sierra Nevada: Deer Creek, Tulare Co., *Dudley* 629; Eight Mile (Yosemite to Wawona), *Jepson* 4298; Calaveras Big Trees, *Hillebrand* 2315; Strawberry Creek, Eldorado Co., *Brainerd* 179.

Refs.—Carex bolanderi Olney, Proc. Am. Acad. 7:393 (1868), type loc. Yosemite Valley, *Bolander* 6209; Mackenzie, Erythea 8:37, fig. 15 (1922). *C. deweyana* W. Boott in Bot. Cal. 2:236 (1880) in part, not Schw.; var. *bolanderi* W. Boott, l.c. *C. bromoides* W. Boott, l.c. 230, not Schk.

Sect. 12. Ovales Kunth. Densely cespitose or (rarely) with short-prolonged rootstocks. Culms triangular. Opaque part of leaf-sheaths not red-dotted or cross-rugulose, but sometimes green-striate. Spikes 2 or 3 up to 20, with several to many perigynia, the terminal gynaecandrous, the lateral pistillate or gynaecandrous, simple, the inflorescence capitate to moniliform. Perigynia scale-like or flat (except where distended by achene) to thick and plano-convex, the body subulate to reniform, narrowly to broadly wing-margined, appressed or ascending or spreading, little corky-thickened at base, prominently beaked, the beak bidentate or obliquely cut, often becoming bidentulate, usually serrulate on the margins. Achenes lenticular. Stigmas 2.

31. **C. feta** Bailey. (Fig. 31j-l.) Culms 5 to 12 dm. high, smooth; leaf-blades 2.5 to 4 mm. wide; head 2 to 8 cm. long, the spikes 5 to 15, greenish, aggregated or more or less separate, 6 to 10 mm. long, the perigynia appressed, or spreading in age; bracts inconspicuous; scales ovate, greenish, acutish; perigynia plano-convex, thickish, ovate, greenish, 3 to 3.5 mm. long, nearly nerveless ventrally, contracted into a flat beak less than ½ length of body.

Foothills and mountains, 100 to 7800 ft.: coastal Southern California; Coast Ranges; Sierra Nevada. North to British Columbia.

Locs.—Southern California: San Juan Capistrano, *Nevin;* San Bernardino Mts., *Parish* 2214. Coast Ranges: Arnolds Run, Santa Clara Co., *Dudley* 4060; Kenwood, Sonoma Co., *Bioletti* 9; Sherwood Valley, *Dudley;* Alder Point, Humboldt Co., *Tracy* 4734; Mt. Shasta, *Jepson* 53a. Sierra Nevada: Mineral King, *Dudley* 1647; Yosemite, *Jepson* 4265, 4297; Columbia, *Jepson* 6411; Avery, Calaveras Co., *A. L. Grant;* Quincy, *Jepson* 4140.

Refs.—Carex feta Bailey, Bull. Torr. Club 20:417 (1893); Mackenzie, Erythea 8:38, fig. 16 (1922). *C. straminea* Willd. var. *mixta* Bailey, Proc. Am. Acad. 22:151 (1886), type from Cal., *Bolander* 50. *C. lagopodioides* W. Boott in Bot. Cal. 2:237 (1880), not Schk. *C. adusta* W. Boott, l.c. 238 (in part), not Boott. *C. cristata* Schw. var. *mirabilis* W. Boott, l.c.

32. **C. fracta** Mackenzie. Culms 5 to 12 dm. high; leaf-blades 3 to 6 mm. wide; head 2.5 to 7.5 cm. long, the spikes 7 to 15, aggregated or the lower slightly separate, short-oblong or obovoid, 8 to 12 mm. long, the perigynia appressed or ascending in age; bracts inconspicuous; scales lance-ovate, acuminate or short-cuspidate, shorter than the perigynia; perigynia lance-ovate, thickish over achene, 3 to 4.5 mm. long, strongly nerved ventrally, narrowly margined, serrulate above; beak about length of body.

Mountains of Southern California; Sierra Nevada; North Coast Ranges; alt. 4000 to 7000 ft. North to Washington.

Locs.—Southern California: San Jacinto Mts., *Hall* 2665; Seven Oaks, San Bernardino Mts., *Geo. B. Grant* 4074; Mt. Wilson, *Grant* 6692 (in part). Sierra Nevada; Lloyd Mt., Tulare Co., *Dudley* 837; Kings River, *Dudley* 3263; North Fork San Joaquin River, *Congdon;* Little Yosemite, *Jepson* 3160, 4403; Yosemite, *Jepson* 4333; Cow Creek, Tuolumne Co., *Jepson* 6520; Slippery Ford, Eldorado Co., *Brainerd.* Coast Ranges: Mt. Sanhedrin, Lake Co., *Heller* 5952; Sisson, *Brainerd* 189.

Refs.—Carex fracta Mackenzie, Erythea 8:38 (1922), type loc. Mt. Shasta, *Pringle.* *C. specifica* Bailey, Mem. Torr. Club 1:21 (1889) in small part. *C. adusta* W. Boott in Bot. Cal. 2:238 (1880) in greater part, not F. Boott. *C. scoparia* var. *fulva* W. Boott, l.c. 237 in small part.

33. **C. straminiformis** Bailey. Leaf-blades 2 to 3.5 mm. wide; head 1.5 to 2.5 cm. long, containing 3 to 6 spikes 6 to 10 mm. long with many spreading-ascending perigynia; scales ovate-lanceolate, acute, reddish-brown; perigynia broadly ovate, strongly winged, nerveless or nearly so ventrally, abruptly beaked, the beak ⅓ length of body.

High summits of the Sierra Nevada, 8000 to 11,700 ft. North to Washington.

Locs.—Cottonwood Lakes, Mt. Whitney, *Jepson* 5067; upper San Joaquin River, Madera Co., *Congdon;* Mt. Buena Vista, Mariposa Co., *Congdon;* Lake Tenaya, *Congdon;* Sonora Pass, *Jepson* 6578; Silver Mt., *Brewer* 2045; Mt. Tallac, *Hall & Chandler* 4617; Lassen Peak, *Brewer* 2184; Mt. Shasta, *Brewer* 1397.

Refs.—Carex straminiformis Bailey, Mem. Torr. Club 1:24 (1889); Kük. in Engler, Pflzr. 4^{20}:195, fig. 32E, F (1909). *C. straminea* Willd. var. *congesta* Boott, ex Olney, Proc. Am. Acad. 7:393 (1868), type loc. Mt. Shasta, *Brewer* 1375.

34. **C. multicostata** Mackenzie. Leaf-blades 2.5 to 6 mm. wide; spikes about 10, 8 to 16 mm. long; scales ovate, obtuse to acute, reddish-brown; perigynia appressed, ovate, several-nerved ventrally, winged to the rounded base, abruptly contracted into the beak 1 mm. long.

Mountains of Southern California; Sierra Nevada in Nevada Co.; rare.

Locs.—San Jacinto Mts., *Hall* 2492; Truckee River, Nevada Co., *Davy.*

Refs.—Carex multicostata Mackenzie, Bull. Torr. Club 43:604 (1917), type loc. Bear Valley dam, San Bernardino Mts., *Parish* 3609. *C. specifica* Parish, Bull. S. Cal. Acad. 5:50 (1906) in small part, not Bailey. *C. festiva* var. *stricta* Parish, l.c. 53 in small part, not Bailey.

35. **C. subfusca** W. Boott. Culms 2 to 6.5 dm. high, smooth; leaf-blades 1.5 to 3 mm. wide; head oblong or ovoid, 1 to 2 cm. long, the spikes 4 to 12, well defined but closely aggregated, ovoid or oblong, 4 to 10 mm. long, rounded at apex, rounded or somewhat tapering at base, the perigynia appressed-ascending; scales ovate, acute, brownish; perigynia ovate, plano-convex, thickish, winged to the rounded base, serrulate above, faintly nerved ventrally, contracted into beak ½ length of body or more.

High montane in coastal Southern California and in the Sierra Nevada, 4000 to 8000 ft.; Coast Ranges from Monterey Co. to Siskiyou Co., mostly 500 to 2500 ft. North to Oregon, east to Arizona.

Locs.—Southern California: Cuyamaca Mts., *Brandegee;* Palomar (Smith Mt.), *Stokes;* San Jacinto Mts., *Reed* 2483; Mt. San Gorgonio, *Hall* 7617; Mt. San Antonio, *Abrams* 1933; San Bernardino Mts., *Parish* 3261. Sierra Nevada: Bisses, Kern Co., *Dudley* 461; Salmon Creek, Tulare Co., *Hall & Babcock* 5162 (in part); Grant Park, *Dudley* 1196; Yosemite, *Dudley;* Cow Creek, Tuolumne Co., *Jepson* 6520a; Squaw Valley, Placer Co., *L. S. Smith* 555; Chico Mdws., *Heller* 12018. Coast Ranges: Tassajara Hot Sprs., *Elmer* 3133; Russian River, Sonoma Co., *Bolander* 3876; Weaverville, *Yates* 297; Castella, Shasta Co., *Piper* 6470; Mt. Eddy, Siskiyou Co., *Eggleston* 11662.

Refs.—Carex subfusca W. Boott in Bot. Cal. 2:234 (1880), type loc. Lake Tahoe, *Kellogg. C. festiva* var. *stricta* Parish, Bull. S. Cal. Acad. 5:53 (1906) in part, not Bailey.

36. **C. praticola** Rydb. Culms 2 to 7 dm. high, roughened beneath head; leaf-blades 1 to 3.5 mm. wide, flat; spikes 2 to 7, elliptic, 6 to 16 mm. long, the upper contiguous, the lower remote; bracts except lowest not developed; scales ovate, acutish, brownish tinged, shining; perigynia concealed by scales, ovate-lanceolate, 4.5 to 6.5 mm. long, narrowly winged, nearly nerveless ventrally, tapering to a short hyaline-tipped beak ⅓ length of body.

Meadows and open woods, Humboldt Co. (Eureka, Tracy 4421). North to Arctic America.

Refs.—Carex praticola Rydb. Mem. N. Y. Bot. Gard. 1:84 (1900). *C. pratensis* Drejer, Revis. Car. Bor. 24 (1841), type loc. Godthaab, Greenland, *J. Vahl;* Kük. in Engler, Pflzr. 4^{20}:198, fig. 32L, M (1909); not C. pratensis Hose in 1797.

37. **C. tracyi** Mackenzie. Head stiff, narrow, 1.5 to 4 cm. long, the spikes 4 to 7, ovoid or short-oblong, 7 to 15 mm. long; scales ovate, acute, covering perigynia, brownish-red; perigynia ovate, 4 to 5 mm. long, winged to the rounded base, serrulate above, strongly nerved dorsally and ventrally, abruptly beaked, the beak obliquely cut dorsally, at length bidentulate, dark reddish-brown at tip, shorter than body.

Humboldt Co. (Bald Mt., Tracy 4547). North to British Columbia.

Ref.—Carex tracyi Mackenzie, Erythea 8:41 (1922), type loc. Bald Mt., Humboldt Co., *Tracy* 4547.

38. **C. phaeocephala** Piper. Spikes 2 to 5 (rarely 7), 6 to 12 mm. long, forming a head 12 to 25 mm. long; lowest bract occasionally developed; scales ovate, acute, dark brownish, covering perigynia; perigynia 4.5 mm. long, obscurely nerved ventrally, contracted into a beak about 1 mm. long.

High peaks of the Sierra Nevada from Mt. Whitney to Mt. Shasta. North to Alaska, east to Colorado.

Locs.—Mt. Whitney, *Jepson*, 1078; Stanislaus Peak, *A. L. Grant* 536; Mt. Tallac, *Hall & Chandler* 4627; Mt. Shasta, *Copeland* 3568.

Refs.—CAREX PHAEOCEPHALA Piper, Contrib. U. S. Nat. Herb. 11:172 (1906), type from Ore., *E. Hall;* Mackenzie, Erythea 8:41, fig. 17 (1922).

39. **C. leporinella** Mackenzie. Spikes 3 to 8, narrowly oblong-oval, 6 to 15 mm. long, forming a head 1.5 to 3 cm. long; lowest bract occasionally somewhat developed; scales ovate, acute, reddish-brown, covering perigynia; perigynia 4 mm. long, few-nerved ventrally, tapering into a beak 1 mm. long.

High summits, central Sierra Nevada, from Mariposa Co. to Placer Co. North to Washington.

Locs.—Tuolumne Soda Sprs., *Congdon;* Summit Valley, Placer Co., *Pringle.*

Refs.—CAREX LEPORINELLA Mackenzie, Bull. Torr. Club 43:605 (1917), type loc. Pyramid Peak, Eldorado Co., *Hall & Chandler* 4716. *C. tenuirostris* Bailey, Mem. Torr. Club 1:15 (1889), not Olney.

40. **C. davyi** Mackenzie. Culms 2.5 to 3.5 dm. high, smooth, slender; leaf-blades 1.5 to 2.5 mm. wide; head about 2.5 cm. long, the spikes oblong-obovoid, 12 to 18 mm. long; bracts not developed; scales oblong-ovate, very obtuse, chestnut; perigynia thin, 7.5 mm. long, striate dorsally and ventrally, narrowly margined to base and serrulate to middle, the sharply bidentate beak not differentiated from body.

High Sierra Nevada from Placer Co. to Tulare Co., 6000 to 10,000 ft.

Locs.—Devils Basin, Eldorado Co., *Brainerd;* Calaveras Big Trees, *Hillebrand* 2322; Mt. Whitney, *Dudley* 2484.

Refs.—CAREX DAVYI Mackenzie, Bull. Torr. Club 43:606 (1917), type loc. Truckee River, Placer Co., *Davy* 3266. *C. siccata* W. Boott in Bot. Cal. 2:230 (1880), not Dew.

41. **C. specifica** Bailey. Culms 2.5 to 8 dm. high, smooth, stiff; leaf-blades 2 to 5 mm. wide; head globose, 1.5 to 4 cm. long, the spikes oblong-ovoid, 6 to 9 mm. long; bracts little developed; scales lance-ovate, acute, reddish-brown; perigynia thin, plano-convex, 6 mm. long, several to many-nerved on both faces, narrowly winged to base, serrulate above, tapering into a bidentate beak $^1/_3$ length of body.

Sierra Nevada from Eldorado Co. to Tulare Co.

Locs.—Echo Lake, Eldorado Co., *Brainerd* 188; Silver Valley, Alpine Co., *Brewer* 1969; Yosemite, *Abrams* 5443; Soda Sprs. of the San Joaquin, *Congdon;* Marble Fork Kaweah River, *Dudley* 1790.

Refs.—CAREX SPECIFICA Bailey, Mem. Torr. Club 1:21 (1889), type loc. Silver Valley, Alpine Co., *Brewer* 1969. *C. scoparia* Schk. var. *fulva* W. Boott in Bot. Cal. 2:237 (1880), same type, excluding *Hillebrand* 2317 and Ore. spms. *C. arida* W. Boott, l.c. not Schw. & Torr. *C. lancifructus* Mackenzie, Bull. Torr. Club 43:607 (1916), type from Volcano Creek, Tulare Co., *Hall & Chandler* 5472.

42. **C. unilateralis** Mackenzie. Culms 2 to 9 dm. high, slender, leaf-blades 2 to 4 mm. wide; spikes 5 to 20, ovoid, 5 mm. long, densely aggregated into an ovoid head 1 to 3 cm. long; lowest 2 or 3 bracts dilated and strongly brownish hyaline margined at base; scales ovate, strongly cuspidate, reddish; perigynia appressed, ovate-lanceolate, thin, 4 to 5 mm. long, wing-margined, serrulate above, tapering into a short flat beak, serrulate nearly to apex.

Wet meadows and copses, Humboldt Co. North to British Columbia.

Refs.—CAREX UNILATERALIS Mackenzie, Erythea 8:43 (1922), type loc. Alton, Humboldt Co., *Tracy* 3783. *C. athrostachya* Kük. in Engler, Pflzr. 4^{20}:193, fig. 32A, B (1909), not Olney.

43. **C. athrostachya** Olney. (Fig. 32a-e.) Culms 1 to 9 dm. high, slender; leaf-blades 1.5 to 4 mm. wide; spikes 4 to 20, ovoid, 4 to 10 mm. long, densely aggregated into an ovoid head 1 to 3 cm. long; lowest 2 or 3 bracts dilated and

strongly brownish hyaline-margined at base, spreading; scales ovate, shorter than the perigynia, acute or short-cuspidate, brown; perigynia ascending, ovate-lanceolate, thin, 3 to 4.5 mm. long, wing-margined, serrulate above, tapering into a beak 1 mm. long, the tip slender, terete.

Wet meadows and copses: San Bernardino Mts.; Sierra Nevada from Tulare Co. to Lassen Co.; North Coast Ranges from Mendocino Co. to Siskiyou Co. North to Alaska, east to Colorado.

Locs.—San Bernardino Mts.: Bear Valley, *Parish* 1573. Sierra Nevada: Kaweah Peaks, *Dudley* 2081; upper San Joaquin River, Madera Co., *Congdon;* Hetch-Hetchy, *Jepson* 3477; Cow Creek, Tuolumne Co., *Jepson* 6518; Truckee, *L. S. Smith* 673; Dewitts, Lassen Co., *Davy* 3298. North Coast Ranges: Sherwood Valley, *Dudley;* Beebe's Ranch, Humboldt Co., *Tracy* 3373; Sisson, *Goldsmith* 13.

Refs.—CAREX ATHROSTACHYA Olney, Proc. Am. Acad. 7:393 (1868), type loc. Yosemite Valley, *Brewer* 1650; Kük. in Engler, Pflzr. 4^{20}:193, fig. 32A, B (1909); Mackenzie, Erythea 8:43, fig. 18 (1922). *C. bonplandii* Bailey, Proc. Am. Acad. 22:152 (1886) in part, not Kunth. *C. athrostachya* Olney var. *minor* Olney in Bot. King 367 (1871), type from Cal.

44. **C. festivella** Mackenzie. Culms 3 to 10 dm. high; leaf-blades 2 to 6 mm. wide; spikes 5 to 20, ovoid, 5 to 12 mm. long, densely aggregated into a head 12 to 25 mm. long; bracts inconspicuous; scales ovate, obtuse to acutish, dark chestnut to brownish-black; perigynia ovate, appressed, lightly nerved ventrally, the beak ½ length of body.

High montane, 7000 to 10,000 ft.: Sierra Nevada from Eldorado Co. to Tulare Co.; White Mts. North to Washington, east to Colorado.

Locs.—Strawberry Creek, Eldorado Co., *Brainerd* 226 in part; Sonora Pass, *Brewer* 1864; Kaweah Mdw., *Dudley* 2208. Poison Creek, White Mts., *Jepson* 7372.

Ref.—CAREX FESTIVELLA Mackenzie, Bull. Torr. Club 42:609 (1915), type loc. Albany Co., Wyo., *Nelson* 3275.

45. **C. nubicola** Mackenzie. Culms 1 to 4 dm. high; leaf-blades 1.5 to 4 mm. wide; head 9 to 18 mm. long, the 4 to 7 densely aggregated ovoid or subglobose spikes 5 to 9 mm. long, the perigynia ascending with spreading beaks; bracts inconspicuous; scales ovate, acute, blackish; perigynia ovate, strongly winged, abruptly contracted into a beak ½ length of body.

Summits of high mountains: Mt. Dana (our only known locality). North to Alberta, east to Colorado.

Refs.—CAREX NUBICOLA Mackenzie, Bull. Torr. Club 36:480 (1909). *C. festiva* Dew. var. *decumbens* Holm, Am. Jour. Sci. ser. 4, 16:20, 26 (1903), type from Pagosa Peak, Colo., *Baker* 232, not *C. decumbens* Ehrh. *C. festiva* Dew. var. *haydeniana* W. Boott in Bot. Cal. 2:234 (1880), type loc. Mt. Dana, *Bolander* 5074.

46. **C. pachystachya** Cham. Culms 3 to 10 dm. high; leaf-blades 2 to 4 mm. wide; spikes 4 to 8, densely aggregated or more or less separate, ovoid or suborbicular, 5 to 8 mm. long, with 10 to 30 at length spreading perigynia; scales ovate, dark colored; perigynia ovate, 3.5 to 5 mm. long, olive-brown, the beak ½ length of body.

Humboldt Co. to Siskiyou Co. North to the Aleutian Isls., east to Colorado. It has a wide altitudinal as well as a wide geographical range, and individual plants vary very considerably.

Locs.—Beebe's Ranch, Humboldt Co., *Tracy* 3390; Mt. Eddy, *Heller* 12468; Mt. Shasta, *Pringle;* Medicine Lake, *Goldsmith* 28a.

Refs.—CALEX PACHYSTACHYA Cham. ex Steud. Synop. Cyper. 197 (1855), type loc. Unalaska. *C. festiva* Dew. var. *pachystachya* Bailey, Mem. Torr. Club 1:51 (1889). *C. olympica* Mackenzie, Bull. Torr. Club 43:610 (1916), n. Cal. to Wash. and B. C.

47. **C. abrupta** Mackenzie. Culms 4 to 6 dm. high; leaf-blades 1.5 to 2.5 mm. wide; head suborbicular, 9 to 17 mm. long, the 4 to 8 spikes ovoid, 5 to 8 mm. long, the perigynia ascending; scales ovate, obtuse, chestnut-brown; perigynia oblong-lanceolate, 3.75 to 4 mm. long, soon brownish tinged, abruptly contracted into the beak.

High montane, 5600 to 10,000 ft., mountains of Southern California and Sierra Nevada; seacoast, Humboldt Co.

Locs.—Southern California: Mt. San Jacinto, *Reed* 2499; Mt. San Gorgonio, *Geo. B. Grant* 6403. Sierra Nevada: Poison Mdw. near Big Arroyo, upper Kern River, *Jepson* 1131; Mt. Dana, *Bolander* 5069; Strawberry, Tuolumne Co., *A. L. Grant* 109; Mt. Tallac, *Abrams* 4848; Hot Springs Valley, Lassen Peak, *Jepson* 4101; Modoc Co., *Manning* 592 (in part). Humboldt Co.: Samoa, *Tracy* 873.

Refs.—CAREX ABRUPTA Mackenzie, Bull. Torr. Club 43:618 (1917), type loc. w. branch North Fork Feather River near Stirling, *Heller* 10820; Erythea 8:45, fig. 19 (1922). *C. nervina* Parish, Bull. S. Cal. Acad. 5:26 (1906), not Bailey. *C. festiva* var. *stricta* Parish, l.c. 53 in part, not Bailey.

48. **C. mariposana** Bailey. Culms 2.5 to 6 dm. high; leaf-blades 2 to 3 mm. wide; head oblong or ovoid, 2 to 3.5 cm. long, the spikes 4 to 12, the upper approximate, the lower 1 to 3 slightly separate, oblong-ovoid, 8 to 12 mm. long, the perigynia closely appressed; scales ovate, acute; perigynia narrowly ovate, 5 mm. long, green or in age straw-colored, tapering into a beak 1/4 length of body.

High montane: 5000 to 9000 ft.: Sierra Nevada from Shasta Co. to Tulare Co.; San Gabriel Mts. and San Bernardino Mts.

Locs.—Sierra Nevada: Hat Creek, Shasta Co., *Eggleston* 7880; Squaw Valley, Placer Co., *L. S. Smith* 558 (in part); Cow Creek, Tuolumne Co., *Jepson* 6515; Yosemite, *Bolander* 4962, 6222; North Fork, Fresno Co., *Griffiths;* Hockett Mdw., Tulare Co., *Dudley* 1901. Southern California: Mt. San Antonio., *Hall* 2416; Mt. San Gorgonio, *Hall* 7635.

Refs.—CAREX MARIPOSANA Bailey, Bull. Torr. Club 43:619 (1917), type loc. Tuolumne Mdws., *Jepson* 4476. *C. preslii* Parish, Bull. S. Cal. Acad. 5:52 (1906), not Steud. *C. adusta* W. Boott in Bot. Cal. 2:238 (1880) in small part, not Boott.

49. **C. integra** Mackenzie. Culms 1.5 to 3.5 dm. high, smooth; leaf-blades 1 to 2 mm. wide; head 1 to 2 cm. long, the spikes 4 to 8, densely aggregated, oblong-obovoid, 4 to 8 mm. long, the perigynia appressed-ascending; scales ovate, acute, dark chestnut; perigynia nerveless or nearly so ventrally, narrowly margined, the beak ½ length of body or more.

Montane. Sierra Nevada from Tulare Co. to Siskiyou Co., 4000 to 8000 ft. North to Oregon.

Locs.—Olancha Mt., *Hall & Babcock* 5249; upper Kings River, *Dudley;* Yosemite, *Abrams* 4399; Slippery Ford, Eldorado Co., *Brainerd* 216; Squaw Valley, Placer Co., *L. S. Smith* 556 (in part); Hat Creek, Shasta Co., *Eggleston* 7380; Mt. Shasta, *H. E. Brown* 357.

Refs.—CAREX INTEGRA Mackenzie, Bull. Torr. Club 43:608 (1917), type loc. Summit, Placer Co., *Heller* 9841; Erythea 8:46, fig. 20 (1922).

50. **C. teneraeformis** Mackenzie. Culms 3 to 4.5 dm. high, very slender, smooth or nearly so; leaf-blades averaging 1.5 mm. wide; head 1.5 to 2.5 cm. long, the spikes 5 to 8, readily distinguishable and more or less separate, 3.5 to 6 mm. long, the perigynia loosely appressed; scales ovate, acute, light brown; perigynia plano-convex, thickish, nerveless or nearly so ventrally, tapering into the slender beak 1 mm. long.

Middle altitudes, 4000 to 8000 ft.: Sierra Nevada from Butte Co. to Tulare Co.; Lake Co.; San Gabriel Mts.

Locs.—Sierra Nevada: Jonesville, Butte Co., *Hall* 9781; Gold Lake, Sierra Co., *Hall & Babcock* 4497; Calaveras Big Trees, *A. L. Grant* 4c; Strawberry, Tuolumne Co., *Jepson* 6505; Eagle Peak, Yosemite, *Jepson* 4374; Hunters Mdw., Fresno Co., *Dudley* 3261; Kaweah River, *Dudley* 1410; Mt. Sanhedrin, *Heller* 5959. Southern California: San Antonio Mts., *Swan & Chase;* Ontario Peak, *Johnston* 1503.

Ref.—CAREX TENERAEFORMIS Mackenzie, Bull. Torr. Club 43:609 (1917), type loc. Jonesville, Butte Co., *Hall* 9781.

51. **C. amplectens** Mackenzie. (Fig. 32d-f.) Culms stiff, 5 to 8 dm. high; leaf-blades 2.5 to 4 mm. wide; head 2.5 to 5 cm. long, the 6 to 12 spikes approximate, oblong-ovoid, 7 to 15 mm. long, the perigynia closely appressed; scales ovate, acute or short-cuspidate, greenish; perigynia ovate, 3.5 to 4 mm. long, light green, narrowly margined, several-nerved on both faces, contracted into a beak ½ length of body or less.

Sierra Nevada from Shasta Co. to Tulare Co., 4000 to 9000 ft.

Locs.—Hat Creek, Shasta Co., *Eggleston* 7493; Yosemite, *Jepson* 4265a, 4388 (in part); Soda Creek, Tulare Co., *Dudley* 1949.

Refs.—CAREX AMPLECTENS Mackenzie, Bull. Torr. Club 43; 611 (1917), type loc. Lover's Leap, Eldorado Co., *Brainerd* 209; Erythea 8:47, fig. 21 (1922).

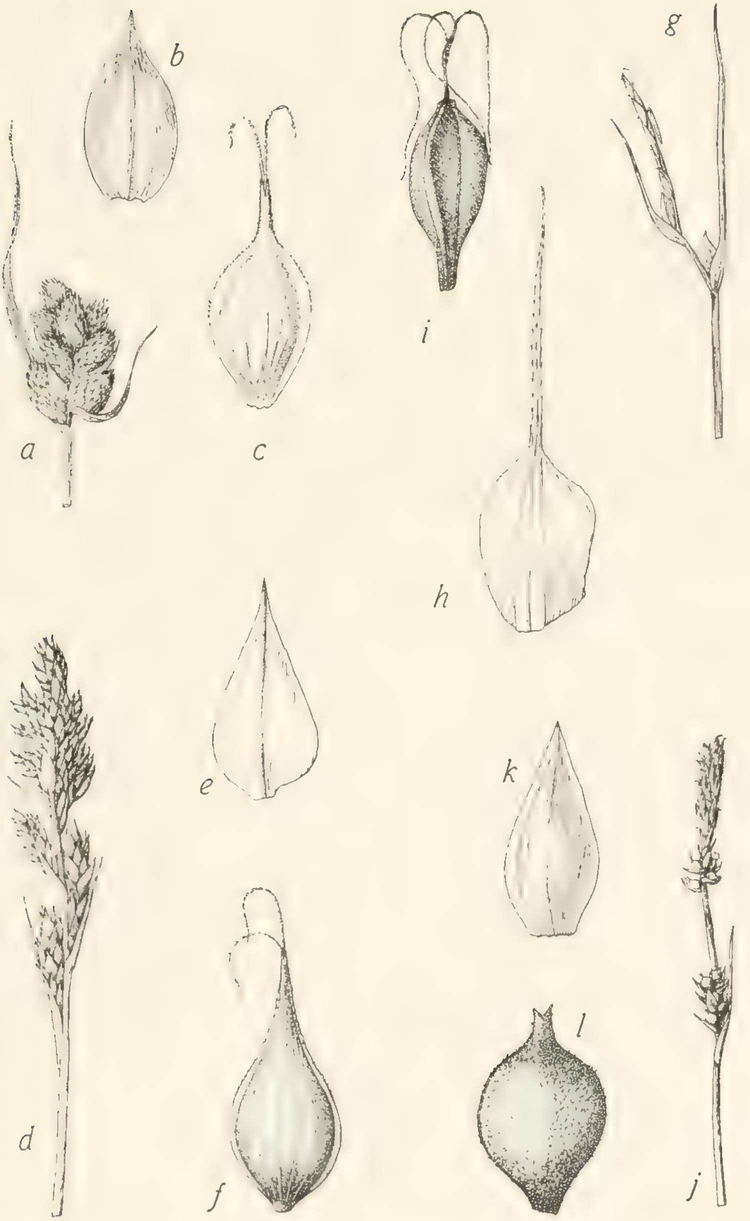

Fig. 32. *a*, CAREX ATHROSTACHYA Olney, inflorescence, × 1; *b*, scale, × 8; *c*, perigynium, × 8. *d*, C. AMPLECTENS Mackenzie, inflorescence, × 1; *e*, scale, × 9; *f*, perigynium, × 9. *g*, C. MULTICAULIS Bailey, inflorescence, × 1; *h*, scale, × 4; *i*, perigynium, × 4. *j*, C. INOPS Bailey, inflorescence, × 1; *k*, scale, × 8; *l*, perigynium, × 8.

52. **C. harfordii** Mackenzie. Culms 2.5 to 8 dm. high; leaf-blades 2.5 to 4.5 mm. wide; head 1.5 to 2.5 cm. long, the 10 to 20 spikes closely aggregated, ovoid, 6 to 10 mm. long, the perigynia appressed-ascending; scales ovate; perigynia narrowly ovate, 3.5 to 4.25 mm. long, tapering into a beak ¼ length of body.

Coastal counties from Humboldt Co. to San Mateo Co.

Locs.—Humboldt Bay, *Chandler* 1115; Petaluma, *Congdon* 364; San Francisco, *Congdon;* South Cahill Ridge, San Mateo Co., *Dudley.*

Refs.—Carex harfordii Mackenzie, Bull. Torr. Club 43:615 (1917), type from Cal., *Kellogg & Harford* 1073. *C. festiva* Dew. var. *stricta* Bailey, Mem. Torr. Club 1:51 (1889) at least in part, type from Cal.

53. **C. montereyensis** Mackenzie. Culms 8 to 10 dm. high; leaf-blades 2.5 to 3 mm. wide; head 1.5 to 2.5 cm. long, the 8 to 12 spikes closely aggregated, ovoid, 6 to 9 mm. long, the perigynia ascending; scales narrowly ovate; perigynia ovate, 3.25 mm. long, tapering into a beak ½ length of body.

Pine forests, Pacific Grove, Monterey Co. (Heller 6786).

Ref.—Carex montereyensis Mackenzie, Erythea 8:92 (1922), type loc. Pacific Grove, *C. P. Smith,* 1055.

54. **C. sub-bracteata** Mackenzie. Head 1.5 to 2.5 cm. long, the spikes 5 to 10, ovoid, 6 to 10 mm. long, the perigynia 10 to 20, appressed or in age appressed-ascending; one or more lower bracts conspicuous; scales ovate, obtuse or acutish, reddish-brown; perigynia narrowly ovate, 3.5 to 4.5 mm. long, thick plano-convex, contracted into a beak ⅓ length of body.

Coast Ranges from Humboldt Co. to Santa Barbara Co.

Locs.—Humboldt Bay, *Hall & Chandler* 1115; Mendocino City, *Bolander* 4771; Russian River, Sonoma Co., *Bolander* 3868 (in part); Lake Merced, San Francisco, *Dudley;* Santa Cruz, *Wood;* Monterey, *Parry;* Santa Barbara, *Elmer* 3756.

Ref.—Carex sub-bracteata Mackenzie, Bull. Torr. Club 43:612 (1917), type loc. Oakland, *Bolander.*

55. **C. gracilior** Mackenzie. Head 12 to 20 mm. long, the spikes 3 to 6, the lower 1 or 2 more or less separate, suborbicular, 5 to 8 mm. long, the 4 to 12 perigynia ascending or spreading-ascending with conspicuous beaks; scales ovate, obtuse or acutish, chestnut-brown; perigynia narrowly ovate, 3.5 to 4.5 mm. long, thick, plano-convex, contracted into a beak ⅓ length of body.

Coast Ranges from Mendocino Co. to San Mateo Co.

Locs.—Sonoma, *R. Kuhn;* Petaluma, *Bolander* 4635; Berkeley, *Harriet Walker* 18; Seal Cove, San Mateo Co., *Dudley.*

Refs.—Carex gracilior Mackenzie, Bull. Torr. Club 43:614 (1917), type loc. Cloverdale, Sonoma Co., *Bolander* 3822. *C. propinqua* Boott, Pac. R. Rep. 4:154 (1857), not Nees & Meyen. *C. festiva* Dew. var. *gracilis* W. Boott in Bot. Cal. 2:234 (1880) in part, not Olney.

56. **C. pachycarpa** Mackenzie. Culms 3 to 6 dm. high, smooth; leaf-blades 2.5 to 4 mm. wide, 1 to 2 dm. long; head 1.5 to 2.5 cm. long, the spikes 5 to 8, closely aggregated, 6 to 10 mm. long, the 10 to 20 perigynia appressed; scales ovate, acute, light reddish-brown; perigynia ovate, plano-convex, thick, 5 mm. long, faintly many-striate ventrally, the beak ½ length of body.

Montane in the Sierra Nevada from Tulare Co. to Siskiyou Co., 5000 to 9000 ft.; Humboldt Co. North to Oregon.

Locs. Sierra Nevada: Alta Mdws., Tulare Co., *Geo. B. Grant;* Mt. Goddard, *Hall & Chandler* 693; Kennedy Lake, Tuolumne Co., *A. L. Grant* 549; Truckee, *Hitchcock* 326; Lassen Peak, *Brewer* 2178; Mt. Shasta, *Brewer* 1375; ne. Modoc Co., *Manning* 952 (in part). Humboldt Co.: Dinsmore Ranch, *Tracy* 4145.

Refs.—Carex pachycarpa Mackenzie, Bull. Torr. Club 43:616 (1917), type loc. Big Tree Road, Silver Valley, *Brewer* 1977. *C. adusta* Boott var. *congesta* W. Boott in Bot. Cal. 2:238 (1880), same type. *C. liddoni* var. *incerta* Bailey, Bot. Gaz. 13:88 (1888), same type.

57. **C. paucifructus** Mackenzie. Culms 1 to 2.5 dm. high; leaf-blades 1.5 to 3 mm. wide, 3 to 7 cm. long; head 1 to 2 cm. long, the spikes 4 to 8, aggregated, 6 to 9 mm. long, the perigynia appressed or appressed-ascending; scales ovate,

chestnut; perigynia 4 mm. long, ovate, thick, strongly plano-convex, nerveless ventrally, tapering into a beak ⅓ length of body.

Sierra Nevada in Sierra and Eldorado cos., 6000 to 7000 ft.

Locs.—Webber Lake, *Kennedy & Doten* 70; Tallac, *Dudley*.

Ref.—CAREX PAUCIFRUCTUS Mackenzie, Bull. Torr. Club 43:615 (1917), type loc. Devils Basin, Eldorado Co., *Brainerd* 200.

Sect. 13. Canescentes Fries. Cespitose, some species with slender stolons. Culms triangular. Sheaths not cross-rugulose. Spikes 1 to 10, with few to many perigynia, simple, the terminal gynaecandrous, the lateral pistillate or gynaecandrous, or rarely all androgynous. Bracts inconspicuous. Perigynia plano- or bi-convex, white-puncticulate, lanceolate, ovoid, oval or obovoid, appressed to spreading, beakless to prominently beaked, more or less nerved on both sides, not winged or margined, but acute-angled above, nearly or entirely filled by the lenticular achene. Stigmas 2.

58. **C. disperma** Dewey. Culms very weak, 1.5 to 6 dm. high; leaf-blades 0.75 to 2 mm. wide, flaccid; spikes distant or upper aggregated, with 1 to 5 ascending perigynia and 1 or 2 staminate flowers; scales shorter than perigynia, ovate-triangular, sharp-pointed; perigynia ovoid-elliptic, 2 mm. long, finely nerved, abruptly beaked, the beak smooth, 0.25 mm. long.

Boggy spots, Sierra Nevada from Tulare Co. to Mono Co., chiefly on the east side. North to Alaska, east to Newfoundland. Also northern Eurasia.

Locs.—Nw. of Whitney Mdws., *Coville & Funston* 1697; Bishop Creek, Inyo Co., *Davidson* 2545; Walker Lake, Mono Co., *Congdon*.

Refs.—CAREX DISPERMA Dewey, Am. Jour. Sci. 8:266 (1824), type from Mass., *Dewey*. *C. tenella* Schk. Riedgr. 1:23, pl. Pp. f. 104 (1801), Schkuhr guessed the type came from Saxony; Kük. in Engler, Pflzr. 4^{20}:223, fig. 36A-C (1909), not C. tenella Thuill., 1799.

59. **C. canescens** L. Culms 1 to 8 dm. high; leaf-blades glaucous, flat, 2 to 4 mm. wide; spikes 4 to 9, 3 to 12 mm. long; scales shorter than perigynia, ovate, sharp-pointed; perigynia appressed-ascending, 1.8 to 3 mm. long, faintly few-nerved, minutely beaked, the beak with margins minutely serrulate.

Swamps and bogs, higher Sierra Nevada from Tulare Co. to Placer Co., 5000 to 9000 ft. North to Alaska, east to Virginia.

Locs.—Mineral King, *Coville & Funston* 1506; Walker Lake, Mono Co., *Congdon;* Glen Alpine Sprs., Eldorado Co., *L. M. Lathrop;* Squaw Valley, Placer Co., *L. S. Smith* 558a, 560.

Refs.—CAREX CANESCENS L. Sp. Pl. 2:974 (1753), type European; Kük. in Engler, Pflzr. 4^{20}:216, fig. 35C-E (1909); Mackenzie, Erythea 8:49, fig. 22 (1922). *C. lagopina* W. Boott in Bot. Cal. 2:233 (1880), not Wahl.

60. **C. arcta** Boott. Culms 1.5 to 8 dm. high, very rough above; leaf-blades 2 to 4 mm. wide; spikes 5 to 15, 5 to 10 mm. long, aggregated; scales shorter than perigynia, ovate, obtusish to short-cuspidate; perigynia ascending or somewhat spreading, ovate, 2 to 3 mm. long, lightly nerved at base ventrally, rounded at base, the beak shallowly bidentate.

Swamps and wet woods, Humboldt Co. (Eureka, Tracy 1195, 3806). North to British Columbia, east to New Brunswick.

Refs.—CAREX ARCTA Boott, Ill. Car. 4:155, pl. 497 (1867); Kük. in Engler, Pflzr. 4^{20}:228, fig. 37A-B (1909). *C. canescens* L. var. *polystachya* Boott in Richards. Arct. Exped. 2:344 (1852), type from British America.

Sect. 14. Polytrichoideae Tuckerm. Densely tufted. Culms slender. Leaf-blades narrow. Spike solitary, linear, androgynous, bractless. Rachis straight, not dilated. Perigynia appressed, membranaceous, the upper part empty, oblong-elliptic, many-nerved, not 2-ribbed, compressed triangular, beakless. Achenes triangular, the sides concave. Stigmas 3, short.

61. **C. leptalea** Wahl. Culms 1.5 to 6 dm. high; leaf-blades 0.5 to 1.25 mm. wide; spike 4 to 15 mm. long; pistillate scales ovate, obtuse to short-pointed, ½ length of perigynia; perigynia 1 to 10, 2.5 to 4.5 mm. long, more or less strongly overlapping, round or somewhat flattened in cross-section.

Bogs and wet meadows, Humboldt Co. (Patricks Point, Tracy 4365). North to Alaska, east to the Atlantic.

Refs.—CAREX LEPTALEA Wahl. Vet. Acad. Handl. Stockholm 139 (1803); Kük. in Engler, Pflzr. 4^{20}:89, fig. 21E-G (1909). *C. polytrichoides* Muhl. in Willd. Sp. Pl. 4:213 (1805), type from Penn.

Sect. 15. Firmiculmes Kük. Culms wiry, triangular, aphyllopodic, the leaf blades often rudimentary at flowering time. Spike one, androgynous, the staminate part in age short-peduncled, the pistillate loosely few-flowered. Bracts absent. Scales more or less chartaceous. Perigynia 1 to several, obtusely triangular, smooth, 2-keeled, but otherwise nerveless, tapering at the base, very minutely beaked, the orifice truncate. Achenes triangular with nearly flat sides, closely enveloped by the perigynia, apiculate-tipped, constricted at base. Stigmas 3, elongated.

62. **C. multicaulis** Bailey. (Fig. 32g-i.) Culms 2 to 6 dm. high, deep green; leaves with well developed blades 1 or 2 to a culm; inflorescence consisting of a terminal staminate part and of 2 to several perigynia in the axils of long (the lower) or short (the upper) awned scales, these enlarged and white hyaline at base; staminate scales very obtuse, broadly white hyaline margined; perigynia oblong-obovoid, 5 to 7 mm. long.

Dry soil, coastal Southern California, 3500 to 6000 ft.: Sierra Nevada from Tulare Co. to Shasta Co., 4000 to 6000 ft.; Coast Ranges from Monterey Co. to Siskiyou Co., 100 to 4000 ft. North to Oregon.

Locs.—Southern California: Cuyamaca, *Brandegee*; San Antonio Mts., *Johnston* 1738; Mt. Lowe, *McClatchie*. Sierra Nevada; Big Tree Cañon, Tulare Co., *Coville & Funston* 1366; Eight Mile, Yosemite to Wawona, *Jepson* 4293; Strawberry Creek, Eldorado Co., *Brainerd*; Sierra Valley, *Lemmon*; Stirling, Butte Co., *Heller* 10794; Quincy, *R. M. Austin* 1004; Susanville, *Jones*. Coast Ranges: Monterey Co., *Davy* 7657; Ukiah, *Bolander* 3906; Rush Creek, Trinity Co., *Yates* 533; Siskiyou Co., *Butler* 853.

Refs.—Carex multicaulis Bailey, Bot. Gaz. 9:118 (1884), type loc. Yosemite Valley, *Torrey* 544; Mackenzie, Erythea 8:51, fig. 23 (1922). *C. geyeri* W. Boott in Bot. Cal. 2:229 (1880), not F. Boott.

63. **C. geyeri** Boott. Culms 1 to 4 dm. high; leaves with well-developed blades usually 2 to a culm, the blades thick, developing after flowering; inflorescence of the terminal staminate part with oblong-ovate striate obtusish straw-colored scales, and 2 or 3 perigynia, the lower in the axils of short-awned scales, the upper in the axils of obtusish or acutish straw-colored scales; perigynia appressed-ascending, oblong, 6 mm. long.

Dry mountain sides and open woods, Siskiyou Co. (Mt. Eddy, Eggleston 11620). North to Alberta, east to Colorado.

Refs.—Carex geyeri Boott, Trans. Linn. Soc. 20:118 (1846), type from the n. Rocky Mts., *Geyer*; Kük. in Engler, Pflzr. 4^{20}:94, fig. 19f-h (1909).

Sect. 16. Filifoliae Tuckerm. Densely cespitose. Leaf-blades filiform or narrow. Spike solitary, linear or linear-oblong, androgynous, densely flowered, bractless. Perigynia more or less triangular, nerveless except for the 2 lateral ribs, submembranaceous, not stipitate, not inflated, puberulent or pubescent, beaked or nearly beakless, hyaline-tipped and obliquely cut at apex. Achenes triangular, apiculate. Stigmas 3.

64. **C. exserta** Mackenzie. Culms very slender and wiry, 5 to 25 cm. high; spike 7 to 15 mm. long, the pistillate part with 2 to 12 ascending perigynia, the pistillate scales orbicular-ovate, obtuse, dull reddish brown with hyaline margins; perigynia obovoid, 2.5 mm. long, essentially beakless.

Dry places in the mountains, 4000 to 11,000 ft.: San Bernardino Mts.; White Mts.; Sierra Nevada from Tulare Co. to Eldorado Co. North to southern Oregon. Forms a large part of the "short-hair meadows" in the Sierra Nevada and is said to be readily eaten by stock.

Locs.—Bear Valley, San Bernardino Mts., *Parish* 1784. White Mts., *Jepson* 7365. Sierra Nevada: Mountain Lake, Tulare Co., *Dudley* 935; Harrison Pass, *Jepson* 5035; Black Mt., Fresno Co., *Hall & Chandler* 616; Little Yosemite, *Jepson* 4396; Yosemite, *Jepson* 4493; Dana Fork Tuolumne River, *Jepson* 3258; Tallac, *Dudley*.

Refs.—Carex exserta Mackenzie, Bull. Torr. Club 42:620 (1915); Erythea 8:52, fig. 24 (1922). *C. filifolia* Nutt. var. *erostrata* Kük. in Engler, Pflzr. 4^{20}:86 (1909), type loc. Echo Lake, Eldorado Co., *Brainerd* 111. *C. filifolia* W. Boott in Bot. Cal. 2:229 (1880), not Nutt.

Sect. 17. Scirpinae Tuckerm. Rootstocks creeping. Culms leafy below. Leaf-blades narrow. Spikes usually 1, linear, staminate or pistillate, many-flowered, normally with an empty scarcely sheathing squamiform bract a short distance below the spike. Perigynia triangular or flattened-triangular, membranaceous, 2 keeled, pubescent or puberulent, tapering at base, constricted at apex into the short cylindric entire or bidentulate beak. Achenes triangular with flat sides, sessile, apiculate. Stigmas 3, short.

65. **C. gigas** Mackenzie. Rootstocks densely matted, culms 3 to 4.5 dm. high; leaves 5 to 10, the blades 2.5 mm. wide; pistillate spike 1.5 to 2.5 cm. long, often with a second smaller peduncled spike; scales oblong-ovate, brownish, covering perigynia; perigynia numerous, black, 3 mm. long, oval, flattish, rounded at apex, the beak 0.5 mm. long, bidentate.

Siskiyou Co., 6800 to 8000 ft.; not otherwise known.

Loc.—Grizzly Hill, *Leiberg* 5104.

Refs.—Carex gigas Mackenzie, Bull. Torr. Club 35:268 (1908), type loc. Siskiyou Co., *Pringle*. *C. scirpoidea* Michx. var. *gigas* Holm, Am. Jour. Sci. ser. 4, 18:20, f. 8 (1904), same type.

Sect. 18. Montanae Fries. Culms slender, leafy at base. Leaf blades narrow, rough above. Terminal spike linear, normally staminate. Lateral spikes 1 to 5, small, pistillate or sometimes androgynous, subglobose to oblong, closely few to many-flowered, approximate and sessile or short-peduncled, or in some species basal and long-peduncled. Lowest bract squamiform or leaflet-like, sheathless or sub-sheathing. Scales often reddish-brown tinged, acute to cuspidate. Perigynia membranaceous, ascending, the body pubescent at least at base of beak, obovoid to elliptic, triangular or round-triangular in cross-section, 2-keeled, strongly stipitate at base, abruptly contracted into a cylindric emarginate to deeply bidentate hyaline-tipped beak. Achenes normally triangular, the sides convex, closely enveloped, short-apiculate. Stigmas normally 3, long.

66. **C. inops** Bailey. (Fig. 32j-l.) Strongly stoloniferous, the culms 2 to 3.5 dm. high, roughened above, reddened and fibrillose at base; leaf-blades 1.5 to 2.5 mm. wide, very rough above; staminate spike 1.5 to 2.5 cm. long, sessile or short-peduncled; pistillate spikes 1 to 3, approximate or more or less separate, sessile or short-peduncled, with 4 to 10 ascending perigynia; scales ovate, sharp-pointed; perigynia 3.5 mm. long, nearly orbicular in cross-section, the beak 0.75 to 1.5 mm. long.

Dry soil, Siskiyou Co. North to Washington.

Loc.—Pilgrim Creek, ne. of Mt. Shasta, *Goldsmith* 2.

Refs.—Carex inops Bailey, Proc. Am. Acad. 22:126 (1886), type loc. Mt. Hood, Ore., *Henderson;* Mackenzie, Erythea 8:54, fig. 25 (1922). *C. verecunda* Holm, Am. Jour. Sci. ser. 4, 16:461 (1903), same type.

67. **C. globosa** Boott. Stoloniferous, the culms 1.5 to 3.5 dm. high, rough above; leaf-blades 1.5 to 2.5 mm. wide; staminate spike short-peduncled, 1 to 2 cm. long; pistillate spikes 5 to 10 mm. long, with 4 to 10 ascending perigynia; lower bract shorter than to exceeding inflorescence; perigynia 5 mm. long, the beak 0.75 to 1.25 mm. long, strongly bidentate.

Coastal counties from San Diego Co. to Sonoma Co.

Locs.—San Diego, *Brandegee;* Santa Cruz Isl., *Brandegee;* Santa Barbara, *Brewer* 302; Little Sur River, *Davy* 7317; Glenwood, Santa Cruz Co., *Dudley;* Mt. Diablo, *Brewer* 1150; Sonoma Co., *Congdon* 84.

Refs.—Carex globosa Boott, Proc. Linn. Soc. 1:259 (1845), type from Cal., *Nuttall.* *C. umbellata* Schk. var. *globosa* Kük. in Engler, Pflzr. 4^{20}:453 (1909).

68. **C. brainerdii** Mackenzie. (Fig. 33a-c.) Culms up to 15 cm. high; leaf-blades 1.5 to 3 mm. wide, much roughened; pistillate spikes 4 to 6, 1 to 4-flowered; lower bract of non-basal spikes exceeding inflorescence, chestnut-tinged, more or less strongly sheathing; perigynia 4.5 mm. long, the beak 1 mm. long.

Sierra Nevada from Mariposa Co. to Siskiyou Co., 4000 to 5000 ft. Also in southern Oregon.

Locs.—Yosemite, *Bolander* 6196; Lassen Peak, *M. E. Jones;* Bartles (20 miles n.), Siskiyou Co., *Goldsmith* 10; Sisson, *Brown* 370.

Refs.—Carex brainerdii Mackenzie, Bull. Torr. Club 40:534 (1913), type loc. Slippery Ford, Eldorado Co., *Brainerd* 121; Erythea 8:54, fig. 26 (1922).

69. **C. brevipes** W. Boott. In dense clumps from stout matted rootstocks, the culms from very short to 18 cm. high; leaf-blades 1.5 to 2.5 mm. wide; staminate spike short-peduncled or sessile, 4 to 12 mm. long; pistillate spikes 3 to 5, usually 10 to 20-flowered, the upper 1 or 2 approximate, sessile to strongly peduncled; scales ovate; perigynia with body little longer than wide.

Montane, 4000 to 7000 ft.: Sierra Nevada from Placer Co. to Tulare Co.; San Gabriel Mts. North to Washington.

Locs.—Summit, Placer Co., *Heller* 9853; Tuolumne Mdws., *Ware* 2721e; Yosemite, *Congdon*; Grant Park, *Dudley* 1905; Kaweah Peaks, *Dudley* 2446; Cucamonga Peak, *Johnston* 1496.

Refs.—Carex brevipes W. Boott in Bot. Cal. 2:246 (1880), type loc. Lake Tahoe to Bear Valley, *Kellogg*. *C. globosa* Boott var. *brevipes* W. Boott, l.c. 485. *C. deflexa* Hornem. var. *boottii* Bailey, Mem. Torr. Club 1:43 (1889), same type. *C. rossii* Boott var. *brevipes* Kük. in Engler, Pflzr. 4^{20}:452 (1909).

70. **C. rossii** Boott. Densely cespitose; culms wiry, 5 to 25 cm. high; leaf-blades 1 to 2.5 mm. wide; staminate spike usually conspicuous, 3 to 10 mm. long; pistillate spikes globose to short-oblong, 3 to 5 mm. long, 2 to 12-flowered, the upper contiguous; scales ovate, sharp-pointed; perigynia nearly globose in cross section.

Sierra Nevada from Mariposa Co. to Shasta Co., thence west to Humboldt Co. North to Alaska, east to Michigan. The most widely distributed and abundant species of the group in the western part of the United States, but sparingly collected with us.

Locs.—Sierra Nevada: Crescent Lake, Mariposa Co., *Congdon*; Tuolumne Soda Sprs., *Congdon*; Stanislaus Forest, Alpine Co., *Eggleston* 9324; Pyramid Peak, *Hall & Chandler* 4749; Hat Creek, Shasta Co., *Eggleston* 7382. Humboldt Co.: Eureka, *Tracy*, 2041.

Refs.—Carex rossii Boott in Hook. Fl. Bor. Am. 2:222 (1840), type loc. nw. coast of N. Am., *Douglas*; Kük. in Engler, Pflzr. 4^{20}:452, fig. 74E-H (1909). *C. novae-angliae* Schw. var. *rossii* Bailey, Bot. Gaz. 10:207 (1885).

71. **C. brevicaulis** Mackenzie. Stoloniferous, the culms 5 to 10 cm. high, very rough; leaf-blades 1.5 to 3.5 mm. wide; staminate spike short-peduncled, few-flowered, 6 to 9 mm. long; lateral spikes 2 to 4, 4 to 6 mm. long, the upper 1 or 2 sessile and approximate; scales ovate, acute to short-cuspidate; perigynia about 4 mm. long, the body globose, 2.25 mm. wide, the beak 1 mm. long.

Along the coast from Monterey Co. to Del Norte Co. North to British Columbia.

Locs.—Monterey, *Elmer* 4531; Ben Lomond Mt., Santa Cruz Co., *Dudley*; Seal Cove, San Mateo Co., *Dudley*; San Francisco, *Kellogg*; Crescent City, *Davy & Blasdale*.

Ref.—Carex brevicaulis Mackenzie, Bull. Torr. Club 40:547 (1913), type loc. Yaquina Bay, Ore., *Howell* 2994.

Sect. 19. Digitatae Fries. Culms slender, leafy at base. Leaf-blades narrow, the sheaths usually strongly purplish. Terminal spike linear, staminate. Lateral spikes 1 to 5, approximate or separate or sometimes basal, oblong to linear, 5- to 20-flowered in few ranks, the peduncles included or exserted. Bracts sheathing, more or less strongly purplish-tinged, subspathaceous, the blade absent to rudimentary. Pistillate scales strongly purplish or reddish-brown tinged. Perigynia membranaceous, appressed, oblong-obovoid, pubescent to glabrate, triangular, long-tapering to the stipitate base, abruptly contracted into the minute beak, the orifice entire or nearly so. Achenes triangular, closely enveloped. Stigmas 3, early deciduous.

72. **C. concinnoides** Mackenzie. Strongly stoloniferous, the culms 1.5 to 3.5 dm. high, smooth; leaf-blades light green, 2 to 4 mm. wide; staminate spike nearly sessile, 8 to 22 mm. long; pistillate spikes 1 or 2, approximate, rather closely 5 to 10-flowered, sessile or short-peduncled; scales narrowly ovate, sharp-pointed, ciliate; perigynia 2.5 to 3 mm. long, loosely pubescent, the beak 0.5 mm. long, wider and longer than the scales.

Dry soil, Mendocino Co. North to British Columbia, east to Montana.

Loc.—Red Mt., nw. Mendocino Co., *Bolander* 6478 (in part).

Refs.—Carex concinnoides Mackenzie, Bull. Torr. Club 33:440 (1906), type loc. Columbia Falls, Mont., *R. S. Williams*; Erythea 8:56, fig. 27 (1922). *C. richardsonii* W. Boott in Bot. Cal. 2:246 (1880), not R. Br.

Sect. 20. Bicolores Tuckerm. Stoloniferous. Culms central, slender, leafy toward base. Leaf-blades narrow. Basal sheaths light brown. Terminal spike linear, staminate or gynaecandrous. Lateral spikes 2 to 5, pistillate, rather closely few to many-flowered, in few ranks on erect exserted peduncles. Bracts sheathing, not colored or dark-auricled, the blades elongated, leaf-like. Scales reddish- or purplish- brown tinged. Perigynia ascending, broadly oval or ellipsoid, circular in cross section, nerved, glabrous, golden-yellow or white-pulverulent at maturity, tapering or rounded at base, essentially beakless. Achenes lenticular, apiculate, closely enveloped. Stigmas 2.

73. **C. salinaeformis** Mackenzie. (Fig. 33d-f.) Culms 5 to 15 cm. high, smooth; leaf-blades 2 to 5 mm. wide; staminate spike 8 to 16 mm. long; pistillate spikes 3 or 4, the upper approximate, short-peduncled, the lower widely separate, long-peduncled, 6 to 12 mm. long, with 8 to 15 appressed-ascending perigynia; perigynia slightly constricted at apex.

Mendocino coast, not otherwise known.

Locs.—Mendocino City, *Bolander* 4702; Fort Bragg, *Davy* 6139.

Refs.—CAREX SALINAEFORMIS Mackenzie, Bull. Torr. Club 36:477 (1909), type loc. Mendocino City, *Bolander* 4702; Erythea 8:57, fig. 28 (1922). *C. salina* Wahl. var. *minor* W. Boott in Bot. Cal. 2:242 (1880), not Boott. *C. salina* Kük. in Engler, Pflzr. 4^{20}:361 (1909) as to Cal. plant, not Wahl.

74. **C. hassei** Bailey. Culms 1.5 to 7 dm. high, usually much roughened above; leaf-blades 2 to 4 mm. wide; staminate spike 6 to 20 mm. long, often pistillate at apex; pistillate spikes 3 to 5, the upper approximate and short-peduncled, the lower long-peduncled, linear-oblong, 8 to 20 mm. long, with 6 to 20 ascending perigynia; perigynia obovoid, 2.5 to 3 mm. long, style becoming short-exserted and somewhat persistent.

River banks and wet rocks: San Gabriel Mts. and San Bernardino Mts.; Sierra Nevada from Tulare Co. to Siskiyou Co., 4000 to 5000 ft.; very local in the Coast Ranges. North to Alaska, east to Labrador.

Locs.—Southern California: San Gabriel River, *Hasse;* San Antonio Mts., *Johnston* 1391; San Bernardino, *Parish* 1055. Sierra Nevada: Bear Creek, Tulare Co., *Dudley* 2858; Yosemite, *Abrams* 4407; Sierra Valley, *Lemmon* 487. Coast Ranges: Mt. Pinos, Kern Co., *Hall;* Loma Prieta, Santa Clara Co., *Elmer* 4865; Sisson, *Dudley.*

Refs.—CAREX HASSEI Bailey, Bot. Gaz. 21:5 (1896), type loc. San Antonio Cañon, San Gabriel Mts., *Hasse.* *C. aurea* Nutt. var. *celsa* Bailey, Mem. Torr. Club 1:75 (1889), type from San Bernardino Mts., *Vasey.*

75. **C. aurea** Nutt. Culms 0.3 to 5.5 dm. high, smooth or somewhat roughened; leaf-blades 2 to 4 mm. wide; staminate spike 3 to 10 mm. long; pistillate spikes 3 to 5, the upper approximate and short-peduncled, the lower separate and often strongly peduncled, 4 to 20 mm. long, with 4 to 20 ascending perigynia; perigynia umbonate, 2 to 3 mm. long.

Wet places, high montane, 5000 to 9000 ft.: Sierra Nevada from Modoc Co. to Tulare Co.; occurring locally in the San Gabriel Mts. and San Bernardino Mts. North to Alaska, east to New England.

Locs.—Sierra Nevada: Big Valley Mts., Modoc Co., *Baker & Nutting;* Little Grizzly Ranger sta., Plumas Co., *Eggleston* 7593; Glen Alpine, *McGregor* 21; Kennedy Mdw., Tuolumne Co., *A. L. Grant* 120, 180a; Mono Lake, *Brewer* 1839; Mineral King, *Coville & Funston* 1429. Southern California: Mt. Pinos, *Hall* 6518; Mt. San Antonio, *Wilder;* Bear Valley, San Bernardino Mts., *Abrams* 2847.

Refs.—CAREX AUREA Nutt. Gen. N. Am. Pl. 2:205 (1818), type loc. shores of Lake Michigan, *Nuttall.* *C. californica* Parish, Bull. S. Cal. Acad. 5:36 (1906), not Bailey.

Sect. 21. Paniceae Tuckerm. Stoloniferous. Culms central, slender. Basal sheaths brownish or purplish tinged. Terminal spike staminate, linear or linear-oblong. Lateral spikes 1 to 5, pistillate, loosely to rather closely several to many-flowered, in few or several ranks, on erect, exserted or included peduncles. Bracts sheathing, not colored or dark-auricled, the blades developed. Scales purplish- or reddish-brown tinged. Perigynia ascending or spreading, ovoid or obovoid, membranaceous, obtusely triangular, slightly inflated, glabrous, puncticulate, light or olive green, pointed or beaked, the orifice entire or nearly so. Achenes triangular, apiculate. Stigmas 3.

76. **C. livida** Willd. Rootstocks very slender; culms 1 to 6 dm. high, smooth, light brownish at base, phyllopodic; leaf-blades 0.5 to 3.5 mm. wide; staminate

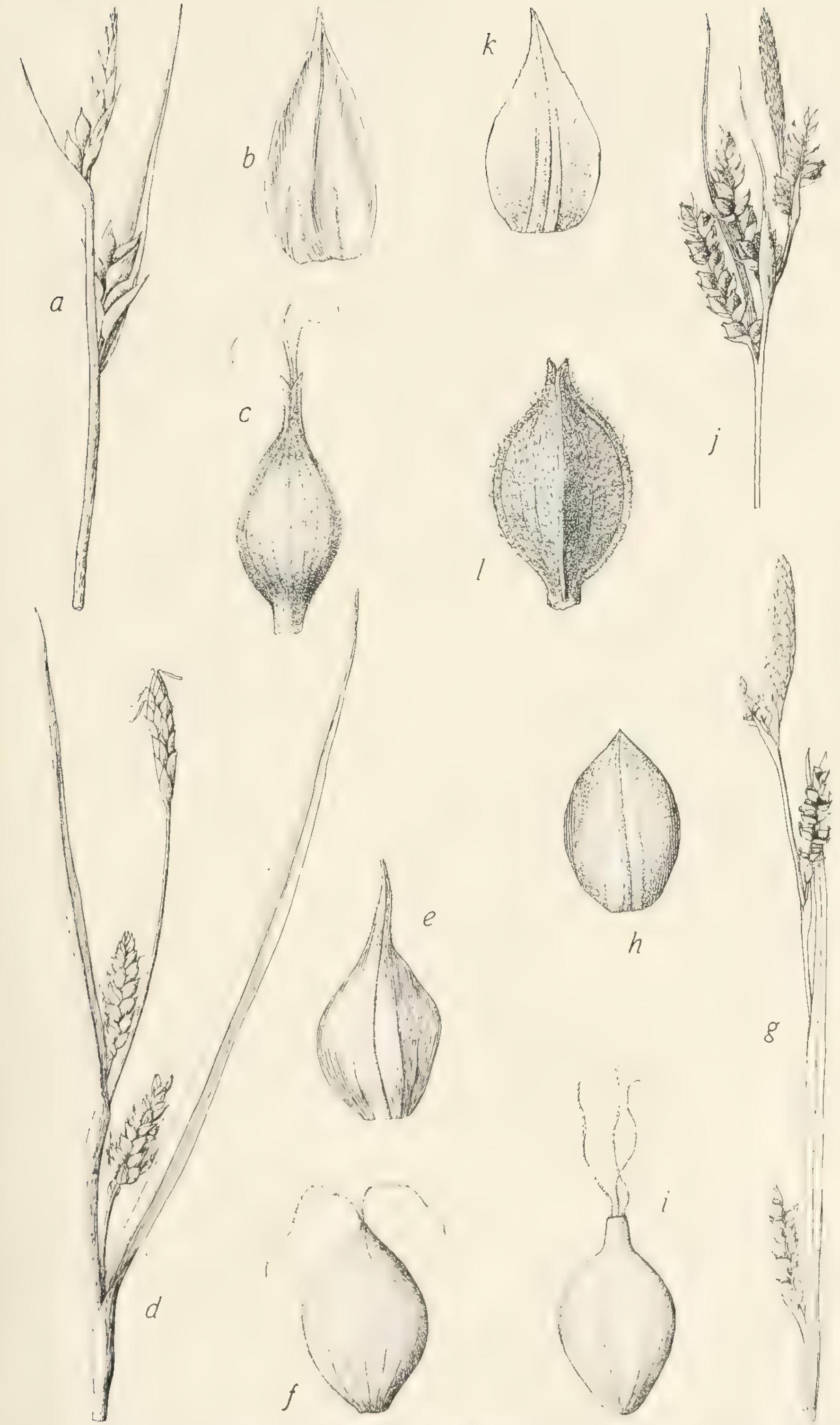

Fig. 33. *a*, CAREX BRAINERDII Mackenzie, inflorescence, × 2; *b*, scale, × 8; *c*, perigynium, × 8. *d*, C. SALINAEFORMIS Mackenzie, inflorescence, × 1; *e*, scale, × 9; *f*, perigynium, × 9. *g*, C. CALIFORNICA Bailey, inflorescence, × 1; *h*, scale, × 8; *i*, perigynium, × 8. *j*, C. TRIQUETRA Boott, inflorescence, × 1; *k*, scale, × 8; *l*, perigynium, × 8.

spike 1.5 to 2.5 cm. long; pistillate spikes 1 or 2, approximate, sessile or short-peduncled, 1 to 2 cm. long, closely 5 to 15-flowered; perigynia 3.5 to 4.5 mm. long, the body ellipsoid, glaucous, faintly nerved, exceeding the scales.

Sphagnum bogs, Mendocino Co. (Mendocino City, Bolander 4745). North to Alaska, east to Labrador.

Refs.—CAREX LIVIDA Willd. Sp. Pl. 4:285 (1805). *C. limosa* L. var. *livida* Wahl. Vet. Akad. Handl. Stockholm 24:162 (1803), type from n. Eur.

77. **C. californica** Bailey. (Fig. 33g-i.) Rootstocks stout; culms 2 to 7 dm. high, smooth, reddish-purple at base, strongly aphyllopodic; culm-leaves 2 to 4, the blades 1.5 to 5 mm. wide, glandular-dotted beneath; staminate spike 1.5 to 3.5 cm. long; pistillate spikes 2 to 4, strongly separate, the upper short exsert-peduncled, the lower often nearly basal and long exsert-peduncled, linear-oblong, 1 to 3 cm. long, with 7 to 20 appressed perigynia; scales hispidulous; perigynia 3.5 to 4 mm. long, the body suborbicular, green, several-nerved, the beak 0.75 mm. long with slightly oblique orifice.

Meadows and prairies, Mendocino Co. (J. W. Congdon). North to Washington. Rare and local.

Refs.—CAREX CALIFORNICA Bailey, Mem. Torr. Club 1:9 (1889), type loc. Mendocino, *Bolander* 4741; Mackenzie, Erythea 8:59, fig. 29 (1922). *C. polymorpha* W. Boott in Bot. Cal. 2:247 (1880), not Muhl. *C. polymorpha* var. *californica* Kük. in Engler, Pflzr. 4^{20}:515 (1909).

Sect. 22. Laxiflorae Kunth. Cespitose. Fertile culms mostly lateral, the sterile shoots leafy, conspicuous. Basal sheaths brownish or purplish-tinged. Terminal spike staminate, linear. Lateral spikes 2 to 5, pistillate or androgynous, loosely to closely few to many-flowered, in few to several ranks, on erect to drooping, included or exserted peduncles. Bracts sheathing, the sheaths green or purplish tinged, the blades leaf-like or sometimes reduced. Scales green with hyaline margins or more or less colored. Perigynia ascending, membranaceous, triangular, usually nerved, closely enveloping the achene, glabrous or hispidulous, tapering at the base, short-beaked or beakless, the orifice entire. Achenes triangular, apiculate. Stigmas 3.

78. **C. hendersonii** Bailey. Culms 4 to 9 dm. high, sharply triangular, rough above; sterile shoots developing conspicuous culms; leaf-blades 3 to 15 mm. wide, spike 1.5 to 3 dm. long; pistillate spikes 2 to 4, erect, 12 to 25 mm. long, with 5 to 12 alternate ascending perigynia, the upper spikes approximate, the lower widely separate; scales broadly obovate, mucronate; perigynia narrowly obovoid, 5 to 6 mm. long, tapering into a straight scarcely differentiated beak.

Damp woods in the Coast Ranges from Sonoma Co. to Humboldt Co. North to British Columbia.

Locs.—Guerneville, *Davy;* Mendocino City, *Bolander* 4747; Eureka, *Tracy* 2202.

Refs.—CAREX HENDERSONII Bailey, Proc. Am. Acad. 22:115 (1886), type loc. Portland Ore., *L. F. Henderson;* Mackenzie, Erythea 8:60, fig. 30 (1922). *C. laxiflora* Lam. var. *plantaginea* Olney, Proc. Am. Acad. 8:407 (1872).

Sect. 23. Triquetrae Carey. Cespitose, leafy toward base. Leaf-blades narrow, the sheaths not purplish tinged. Terminal spike linear, staminate. Lateral spikes 2 to 4, approximate or more or less separate or sometimes basal, 5- to 30-flowered in few ranks. Bracts sheathing, not purplish tinged, the lowest with a well-developed blade. Pistillate scales greenish or hyaline or reddish-brown tinged. Perigynia membranaceous, ascending, obovoid, short-pubescent or glabrous, triangular, tapering and more or less stipitate at base, abruptly contracted into the minute beak, the orifice obliquely cut, minutely bidentate. Achenes triangular, closely enveloped. Stigmas 3, early deciduous.

79. **C. flaccifolia** Mackenzie. Culms 6 to 9 dm. high; leaf-blades about 3 mm. wide; staminate spike 1 to 2.5 cm. long, short-peduncled; pistillate spikes mostly 3, approximate or somewhat separate, sessile or short-peduncled, 1 to 2.5 cm. long, rather loosely 8- to 25-flowered; scales ovate, cuspidate; perigynia short-tapering at base, the beak 0.5 mm. long, bidentulate.

Dry plains in southwestern California.

Ref.—CAREX FLACCIFOLIA Mackenzie, Erythea 8:92 (1922), type from sw. Cal., *Geo. B. Grant,* May 1, 1902.

80. **C. whitneyi** Olney. Culms 2.5 to 10 dm. high; leaf-blades 2.5 to 8 mm. wide; staminate spike peduncled, 5 to 30 mm. long; pistillate spikes 2 to 4, approximate or lower separate, erect, sessile or short-peduncled, 7 to 30 mm. long, closely 5 to 30-flowered; scales ovate, acute or short-cuspidate; perigynia round-tapering at base.

Sierra Nevada from Tulare Co. to Plumas Co., 4000 to 7000 ft. North to Oregon.

Locs.—Tobias Mdw., Tulare Co., *Dudley* 614; Yosemite, *Jepson* 4348; Tuolumne Mdws., *Jepson* 4477; Donner Lake, *Heller* 6941; Iron Cañon, Butte Co., *R. M. Austin* 57; Devil's Kitchen, Lassen Peak, *R. M. Austin* 1300.

Refs.—CAREX WHITNEYI Olney, Proc. Am. Acad. 7:394 (1868), type loc. Yosemite Valley, *Brewer* 1639; Mackenzie, Erythea 8:61, fig. 31 (1922).

81. **C. gynodynama** Olney. Culms 2 to 9 dm. high, slender, brownish at base; leaf-blades 3 to 9 mm. wide; terminal spike usually staminate, 1 to 2 cm. long; lateral spikes 2 to 4, oblong-cylindric, 1 to 3.5 cm. long, closely 20 to 40-flowered, the upper approximate, usually overtopping the staminate spike, short-peduncled, the lower strongly separate, long-peduncled; scales ovate-orbicular, short-cuspidate or obtuse; perigynia ascending, the beak 0.75 mm. long.

Coast Ranges from San Mateo Co. to Humboldt Co. North to Oregon.

Locs.—Pescadero, San Mateo Co., *Dudley;* Fort Ross, Sonoma Co., *Heller* 6605; Sherwood Valley, *Dudley;* Eureka, *Tracy* 3577.

Refs.—CAREX GYNODYNAMA Olney, Proc. Am. Acad. 7:394 (1868), type loc. Mendocino City, *Bolander* 4700. *C. blankinshipii* Fern. Erythea 7:121 (1899), type loc. Hydesville, Humboldt Co., *Blankinship.*

82. **C. hirtissima** W. Boott. Culms 3 to 6 dm. high, erect, purplish red at base; leaf-blades 3 to 7 mm. wide; terminal spike staminate or gynaecandrous, peduncled, 1.5 to 2.5 cm. long; pistillate spikes 2 or 3, linear, 1 to 2.5 cm. long, more or less strongly separate, the lower on long-exserted peduncles, closely flowered with 20 to 30 ascending perigynia; scales ovate or obovate, cuspidate or mucronate, the margins broad, white-hyaline; perigynia ascending, the conic beak 1 mm. long.

Sierra Nevada from Nevada Co. to Mariposa Co., 3700 to 7000 ft.; Lake Co. Rare and local.

Locs.—Hetch-Hetchy, *Congdon;* e. base Mt. Sanhedrin, *Reynolds.*

Ref.—CAREX HIRTISSIMA W. Boott in Bot. Cal. 2:247 (1880), type loc. Summit Sta., Nevada Co., *Kellogg.*

83. **C. triquetra** Boott. (Fig. 33j-l.) Culms 3 to 6 dm. high, stiffish; leaf-blades 2.5 to 6 mm. wide, the sheaths cinnamon-brown tinged and purplish spotted ventrally; staminate spike 1 to 3 cm. long; lateral spikes 3 or 4, erect, the upper little exsert-peduncled, approximate, the lower 1 or 2 often widely separate and long exsert-peduncled, 1 to 4.5 cm. long, the 5 to 30 perigynia ascending; scales ovate, short-cuspidate, brownish copper-color; perigynia 4 to 4.5 mm. long, softly short-pubescent, light green, obscurely several-nerved, the beak 0.3 mm. long.

Dry hillsides below 2000 ft. from Santa Barbara Co. to San Diego Co. Lower California.

Locs.—Santa Inez Mts., *Brandegee;* Ojai Valley, *Elmer* 3955; Los Angeles, *Hasse;* Avalon, *Trask;* San Antonio Mts., *Johnston* 1917; San Bernardino Valley, *Parish* 6250.

Refs.—CAREX TRIQUETRA Boott, Trans. Linn. Soc. 20:126 (1846), type loc. probably near Santa Barbara, *Nuttall;* Mackenzie, Erythea 8:62, fig. 32 (1922). *C. monticola* Dew. Bot. Mex. Bound. 229 (1858), type from San Diego, *Parry.*

Sect. 24. Debiles Carey. Culms aphyllopodic, strongly purplish tinged at base, tufted, slender, leafy. Leaf-blades flat. Terminal spike normally staminate. Lateral spikes 2 to 5, elongate, narrowly linear, slender-peduncled, the lower often drooping. Bracts green-sheathing, the blades leaflike. Perigynia appressed or ascending, lanceolate to ovoid, membranaceous, obsoletely nerved, rather closely enveloping the achene, tapering to a well-developed conic beak, obliquely cut at orifice and strongly hyaline-tipped, at length bidentate. Achenes triangular, apiculate. Stigmas 3.

84. **C. mendocinensis** Olney. Culms 3 to 8 dm. high, much exceeding leaves; leaves minutely pubescent, the blades 1.75 to 4 mm. wide; staminate spike 2 to 3.5 cm. long; pistillate spikes 2 or 3, slender, erect, 1.5 to 4 cm. long, closely flowered above, the 20 to 40 perigynia appressed-ascending; scales ovate, obtuse or short-cuspidate, cinnamon-brown; perigynia 3.5 to 5 mm. long, oblong-obovoid, somewhat flattened, lightly nerved, minutely puberulent, the beak 0.5 mm. long.

Along streams from Mendocino Co. to Humboldt Co. North to Oregon.

Locs.—Mendocino, *Bolander* 4701; Three Creeks, Humboldt Co., *Tracy* 3343.

Refs.—CAREX MENDOCINENSIS Olney ex W. Boott in Bot. Cal. 2:249 (1880), type loc. Mendocino City, *Bolander* 4701; Mackenzie, Erythea 8:63, fig. 33 (1922). *C. cinnamomea* Olney, Proc. Am. Acad. 7:396 (1868), type from Mendocino Co., *Bolander* 6477, not *C. cinnamomea* Boott.

Sect. 25. Frigidae Fries. Culms phyllopodic, tufted, the leaves clustered near the base. Spikes staminate, pistillate, androgynous or gynaecandrous. Bracts green-sheathing, the blades developed or rudimentary. Scales dark-tinged, usually with light midvein and margins. Perigynia appressed or ascending, flat to flattened-triangular, not inflated, dark-tinged, beaked, the beak hyaline at orifice, more or less bidentate. Achenes triangular, short apiculate. Stigmas 3.

85. **C. lemmonii** W. Boott. Culms slender, 2 to 8 dm. high, smooth, exceeding leaves; leaf-blades 1.5 to 4 mm. wide, erect; staminate spike 6 to 25 mm. long, sessile or short-peduncled; pistillate spikes 2 to 4, linear-oblong, 0.5 to 2 cm. long, 5- to 30-flowered, the upper approximate, the lower separate and exsert-peduncled; perigynia with beak 1 mm. long, sparingly ciliate-serrulate.

High montane, 6000 to 8500 ft.: Sierra Nevada from Tehama Co. to Tulare Co.; San Bernardino Mts.

Locs.—Lassen Forest, Tehama Co., *Eggleston* 7302; Strawberry Creek, Eldorado Co., *Brainerd* 30; Matterhorn Cañon, Yosemite Park, *Jepson* 4500; Mariposa Big Trees, *Congdon*; Boulder Creek, Fresno Co., *Dudley* 3298; Board Camp Creek, Tulare Co., *Dudley*. San Bernardino Mts.: High Creek, Mt. San Gorgonio, *Geo. B. Grant* 6405; Bear Valley, *Abrams* 2816.

Refs.—CAREX LEMMONII W. Boott, Bot. Gaz. 9:93 (1884), type from the Sierra Nevada, *Lemmon*. *C. fulva* Good. var. *hornschuchiana* W. Boott in Bot. Cal. 2:250 (1880), not F. Boott. *C. ablata* Parish, Bull. S. Cal. Acad. 4:80 (1905), not Bailey. *C. abramsii* Mackenzie, Bull. Torr. Club 36:482 (1909), type loc. San Bernardino Mts., *Abrams* 2816. *C. serratodens* Kük. in Engler, Pflzr. 4^{20}:666 (1909) in part, not W. Boott.

86. **C. luzulina** Olney. Culms 1.5 to 9 dm. high; leaf-blades 3 to 8 mm. wide, stiff; spikes 4 to 8, the upper clustered, the lower widely separated, on long-exserted peduncles, the lateral pistillate, 7 to 20 mm. long, 6 to 9 mm. wide; perigynia 4 to 5 mm. long, contracted into the short or in age conspicuous, sparingly ciliate-serrulate dark purplish-tipped beak.

Sonoma Co. to Humboldt Co. North to southern Oregon.

Locs.—Santa Rosa Creek, *Bigelow*; Fort Bragg, *Congdon*; Bald Mt., Humboldt Co., *Tracy* 4531, 4543.

Refs. CAREX LUZULINA Olney, Proc. Am. Acad. 7:395 (1868), type loc. Mendocino City, *Bolander* 4746. *C. cherokeensis* W. Boott in Bot. Cal. 2:248 (1880), not Schw. *C. albida* Bailey, Mem. Torr. Club 1:9 (1889), type from Santa Rosa Creek, *Thurber, Bigelow*. *C. luzulaefolia* W. Boott var. *ablata* Kük. f. *albida* Kük. in Engler, Pflzr. 4^{20}:558 (1909).

87. **C. ablata** Bailey. Culms slender, smooth, 2.5 to 6 dm. high, much exceeding leaves; leaf-blades 3 to 4.5 mm. wide; spikes 3 to 7, the upper clustered and sessile or nearly so, the lower usually widely separate and on slender exserted peduncles, the terminal usually staminate, the lateral mostly pistillate, 8 to 30 mm. long; perigynia lanceolate, greenish, 3.5 to 5 mm. long, obscurely nerved, slightly ciliate-serrulate, rounded at base, the beak scarcely 1 mm. long, dark purplish-tipped.

Mountain meadows and bogs, Siskiyou Co. (Shasta Forest, *Eggleston* 11668). North to British Columbia, east to Montana.

Refs.—CAREX ABLATA Bailey, Bot. Gaz. 13:82 (1888); Macoun, Cat. Canad. Pl. 4:139 (1888), type loc. Mt. Mark, Vancouver Isl., *Macoun*. *C. luzulaefolia* W. Boott var. *ablata* Kük. in Engler, Pflzr. 4^{20}:558 (1909).

88. **C. luzulaefolia** W. Boott. (Fig. 34a-c.) Culms 4 to 10 dm. high; leaf-blades 5 to 15 mm. wide; terminal spike peduncled, 1 to 2 cm. long, often with 1 or 2 sessile staminate spikes at its base; pistillate spikes 3 to 6, all or only the lower strongly exsert-peduncled, widely separate, the upper often equaling the staminate spikes, oblong-cylindric, 1.5 to 2.5 cm. long, the 20 to 50 perigynia appressed; perigynia 4 to 5.5 mm. long, oblong-ovate, the beak 1.5 to 2 mm. long.

High montane, 7000 to 9500 ft., Sierra Nevada from Shasta Co. to Tulare Co.

Locs.—Hat Creek, Shasta Co., *Eggleston* 7472; Mt. Tallac, *Abrams* 4838; Carson Pass, *Brewer* 2131; Kennedy Lake, Tuolumne Co., *A. L. Grant* 479; Soda Cañon near Big Arroyo, *Jepson* 1130.

Refs.—CAREX LUZULAEFOLIA W. Boott in Bot. Cal. 2:250 (1880) in greater part, type loc. above Ebbetts Pass, *Brewer* 2019; Mackenzie, Erythea 8:65, fig. 34 (1922). *C. luzulaefolia* var. *strobilantha* Holm, Am. Jour. Sci. 20:305, f. 18 (1905), type loc. Donner Lake, *Heller* 7187. *C. pseudo-japonica* C. B. Clarke, Kew Bull. Misc. Inf. add. ser. 8:81 (1908), type loc. Donner Lake, *Heller* 7187.

89. **C. fissuricola** Mackenzie. Culms 5 to 8 dm. high; leaf-blades 3 to 8 mm. wide; terminal spike sessile or short-peduncled, often slightly pistillate; lateral spikes 4 or 5, the upper contiguous and sessile or short-peduncled, the lower separate and strongly peduncled; perigynia narrowly ovate, 4.5 to 5 mm. long, abruptly beaked, the beak 1.5 mm. long.

Mountain meadows, 5500 to 10,000 ft., Sierra Nevada from Tulare Co. to Placer Co. East to Nevada.

Locs.—Hockett Mdw., Tulare Co., *Dudley* 1008; Mt. Whitney, *Dudley* 2481; Mariposa Big Trees, *Congdon;* Echo, Eldorado Co., *Brainerd;* Emigrant Gap, *Jones* 2917.

Refs.—CAREX FISSURICOLA Mackenzie, Muhl. 5:53 (1909), type loc. South Fork Humboldt River, Elko Co., Nev., *Heller* 9429. *C. luzulaefolia* W. Boott in Bot. Cal. 2:250 (1880) in part. *C. ablata* Bailey var. *luzuliformis* Bailey, Bot. Gaz. 25:272 (1898), type from Cal., *Bolander* 6210. *C. luzulaefolia* W. Boott var. *ablata* Kük. f. *luzulaeformis* Kük. in Engler, Pflzr. 4^{20}:558 (1909).

Sect. 26. Anomalae Carey. Culms stout, leafy. Leaf-blades broad, flat, glabrous, not septate-nodulose. Terminal spike staminate, linear. Lateral spikes pistillate, linear-cylindric, scattered, closely many flowered in several rows. Bracts leaflike, sheathless. Perigynia ascending or in age spreading, obovoid, small, olive green, tapering at base, triangular, slightly inflated, thin, abruptly beaked, the beak conic, lightly bidentate. Achenes triangular, apiculate, more or less closely enveloped. Stigmas 3.

90. **C. amplifolia** Boott. Long-stoloniferous, the culms 5 to 10 dm. high; leaf-blades 8 to 18 mm. wide, nearly smooth above; terminal spike 4 to 9 cm. long; pistillate spikes 3 to 6, the upper approximate, the lower more or less strongly separate, short-peduncled or nearly sessile, 3.5 to 14 cm. long; scales pointed; perigynia 3 mm. long, glabrous, nerveless except for keels, long-beaked, the beak often excurved.

Wet soil, Sierra Nevada from Tulare Co. to Butte Co., 4000 to 8000 ft.; Coast Ranges from San Mateo Co. to Siskiyou Co., 1500 to 4000 ft. Northerly to British Columbia and Idaho.

Locs.—Sierra Nevada: Mineral King, *Dudley* 1581; Dinkey Creek, Fresno Co., *Hall & Chandler* 369; Mariposa Big Trees, *Bolander* 5011; Sierra Valley, *Lemmon;* Jonesville, Butte Co., *Hall* 9782. Coast Ranges: Kings Mt., San Mateo Co., *Abrams* 5563; Howell Mt., Napa Co., *Tracy* 1606; Bald Mt., Humboldt Co., *Tracy* 4530; Sisson, *Brainerd* 98.

Refs.—CAREX AMPLIFOLIA Boott in Hook. Fl. Bor. Am. 2:228, pl. 226 (1840), type loc. Columbia River, *Douglas;* Mackenzie, Erythea 8:67, fig. 35 (1922).

Sect. 27. Atratae Kunth. Culms aphyllopodic or phyllopodic. Terminal spike gynaecandrous or staminate, the lateral 1 to 10 pistillate or with a few staminate flowers at base, from sessile, erect and closely approximate to long peduncled, nodding and distant. Bracts sheathless or nearly so, dark-colored at the base, the blades short. Scales usually dark-tinged. Perigynia membranaceous or more or less coriaceous, straw-colored or greenish, often strongly dark-tinged, elliptic to broadly obovate, circular in cross-section to much flattened, papillose to puncticulate, glabrous, abruptly short-beaked or beakless, the orifice entire or bidentate. Achenes triangular, apiculate-tipped. Stigmas 3.

91. **C. spectabilis** Dew. Culms 2.5 to 5 dm. high, from densely matted tough rootstocks; leaf-blades 2 to 3.5 mm. wide; pistillate spikes 2 to 4, oblong, 1 to 2 cm. long, closely 15- to 30-flowered, not aggregated, the upper short-peduncled,

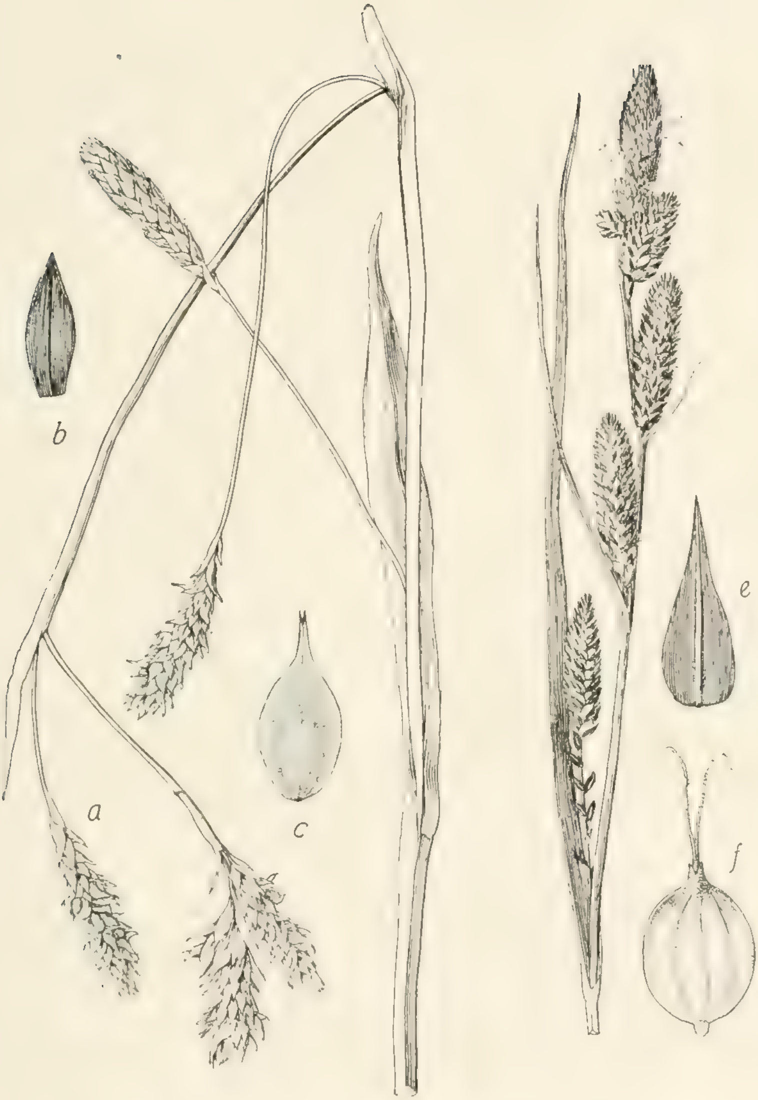

Fig. 34. *a*, CAREX LUZULAEFOLIA W. Boott, inflorescence, × 1; *b*, scale, × 4; *c*, perigynium, × 4. *d*, C. NEBRASKENSIS Dewey, inflorescence, × 1; *e*, scale, × 7; *f*, perigynium, × 7.

the lower long-peduncled; scales purplish-black with white often excurrent midvein; perigynia flattened, ovoid, sessile, 4 mm. long, abruptly minutely beaked, the beak bidentulate; achene short-stipitate.

High Sierra Nevada, 6000 to 11,000 ft., from Tulare Co. to Siskiyou Co. North to Alaska, east to Montana.

Locs. Mt. Whitney, *Copeland* 17; Minarets, *Congdon*; Mt. Dana, *Congdon*; Carson Pass, *Brewer* 2106; Pyramid Peak, *Brewer* 2136; Lassen Peak, *Brewer* 2186; Caribou Peak, Siskiyou Co., *Dudley*.

Refs.—Carex spectabilis Dew. Am. Jour. Sci. 29:248, pl. X, f. 76 (1836), type from Rocky Mts. of Brit. Am. *C. invisa* Bailey, Proc. Am. Acad. 22:82 (1886), type from Summit Camp, Nevada Co., *Kellogg*. *C. podocarpa* W. Boott in Bot. Cal. 2:245 (1880), not R. Br. *C. tolmiei* Boott var. *invisa* Kük. in Engler, Pflzr. 4^{20}:412 (1909).

92. **C. raynoldsii** Dew. Culms 2 to 7.5 dm. high; leaf-blades 3 to 8 mm. wide; terminal spike 1 to 2 cm. long, the lateral pistillate spikes 2 or 3, approximate or lowest separate, peduncled, erect, oblong, 1 to 2 cm. long, closely 15 to 40-flowered; perigynia oblong-oval, round in cross-section, 3.5 to 4.5 mm. long, prominently ribbed and slenderly nerved, rounded at base, the very short beak minutely bidentate.

Mountain meadows and bogs, Sierra Nevada from Tulare Co. to Siskiyou Co., 7000 to 8000 ft.. North to Canada.

Locs.—Tobias Mdw., Tulare Co., *Dudley* 616; Peregoy Mdws., Yosemite Park, *Jepson* 4340; Tuolumne Mdws., *Jepson* 3259; Calaveras Big Trees, *Hillebrand* 2323 (in part); Summit, Placer Co., *Heller* 9854; Medicine Lake, Siskiyou Co., *Goldsmith* 5a.

Refs.—Carex raynoldsii Dew. Am. Jour. Sci. ser. 2, 32:39 (1861), type loc. Pierre's Hole, Snake River Valley, Ida., *Hayden*; Mackenzie, Erythea 8:68, fig. 36 (1922).

93. **C. bifida** Boott. Culms sharply triangular, slender, smooth, 4 to 8 dm. high, the basal sheaths purplish-tinged; leaf-blades 1.75 to 3.5 mm. wide; terminal spike 1.5 to 3 cm. long, staminate or with some perigynia; pistillate spikes 3 to 5, erect, short-peduncled or sessile, oblong, 8 to 18 mm. long, with 20 to 40 at length spreading perigynia; scales ovate, sharp-pointed; perigynia narrowly ovate, flattened triangular, about 10-nerved, 3 to 4.5 mm. long, the beak 0.5 to 1 mm. long, the teeth minute, rough and purplish-tinged within.

Tehachapi Range; Coast Ranges from San Luis Obispo Co. to Humboldt Co. North to southern Oregon.

Locs.—Tehachapi, *Greene*; San Luis Obispo, *Jones* 3235; Santa Lucia Peak, *Jepson* 4739; Los Gatos, *Heller* 8570; Spring Valley, San Mateo Co., *Congdon*; Mt. Tamalpais, *Piper* 6430; Los Guilicos Valley, Sonoma Co., *Bioletti*; Red Mt., Mendocino Co., *Bolander* 6476.

Refs.—Carex bifida Boott, ex Olney, Proc. Am. Acad. 7:394 (1868), type loc. Salinas Valley, *Brewer* 574; Mackenzie, Erythea 8:69, fig. 37 (1922). *C. serratodens* W. Boott in Bot. Cal. 2:245 (1880), type from Cal. *C. aequa* C. B. Clarke, Kew Bull. Misc. Inf. add. ser. 8:86 (1908), type from San Mateo Co., *Baker* 811.

94. **C. buxbaumii** Wahl. Densely cespitose, but with long stolons; culms 2 to 9 dm. high, rough above, slender; leaf-blades 2 to 4 mm. wide, glaucous-green; spikes usually 3 or 4, erect, 8 to 40 mm. long, sessile or short-peduncled; scales awned, dark purplish-tinged, exceeding perigynia; perigynia 3 to 4 mm. long, glaucous-green, obovoid, lightly many-nerved, the apex minutely bidentate.

Bogs in the high Sierra Nevada of Tuolumne Co. (Tuolumne Soda Sprs., Bolander 5056). North to Alaska, east to the Atlantic. Eurasia.

Ref.—Carex buxbaumii Wahl. Vet. Akad. Hadl. Stockholm 24:163 (1803), based on plants of Sweden and Lapland.

95. **C. helleri** Mackenzie. Very densely cespitose, the culms 0.5 to 3 dm. high; leaf-blades 2 to 3.5 mm. wide; spikes oblong, 10 to 20 mm. long, densely 25- to 50-flowered; scales acuminate or aristate, much narrower than perigynia; perigynia broadly oval to suborbicular, much flattened, 2.5 to 3.5 mm. long, nerveless, abruptly beaked, the beak 0.25 mm. long, bidentate; achenes short-stipitate.

High montane, 8500 to 13,600 ft.: Sierra Nevada from Tulare Co. to Eldorado Co.; White Mts. East to Nevada.

Locs.—Kaweah Peaks, *Dudley* 2114; Harrison Pass, *Jepson* 5039; Mt. Dana, *Bolander* 5072; Sonora Peak, *A. L. Grant* 522 (in part); Lake Lucille, *Hall & Chandler* 4663; White Mts., *Jepson* 7395.

Refs.—Carex helleri Mackenzie, Erythea 8:70, fig. 38 (1922), type loc. Mt. Rose, Washoe Co., Nev., *Heller* 9975. *C. atrata* L. var. *nigra* W. Boott in Bot. Cal. 2:239 (1880), not F. Boott.

96. **C. epapillosa** Mackenzie. Culms 1.5 to 6 dm. high, stiff, sharply triangular, smooth; leaf-blades 3 to 8 mm. wide; spikes 3 to 6, approximate or a little separate, sessile or short-peduncled, oblong-ovoid, 1 to 2.5 cm. long, closely flowered; scales lance-ovate, sharp-pointed, narrower than but about equaling or exceeding perigynia; perigynia broadly oval or obovate, obscurely nerved.

Mountain meadows, high Sierra Nevada of Tuolumne Co. (Sonora Peak, A. L. Grant 394, 413). Easterly to Wyoming.

Ref.—Carex epapillosa Mackenzie in Rydb. Fl. Rocky Mts. 138 (1917), type loc. Marysvale, Utah, *Jones* 5345.

97. **C. heteroneura** W. Boott. Culms 2.5 to 10 dm. high, slender, smooth or nearly so; leaf-blades 2 to 4 mm. wide; spikes 3 to 6, approximate or lower more or less strongly separate, sessile (the upper) to strongly peduncled (the lower), oblong, 0.7 to 2.5 cm. long, closely flowered with 15 to 40 appressed-ascending perigynia; scales acute, narrower than perigynia; perigynia suborbicular, strongly flattened, rounded at base and apex, the beak 0.25 mm. long, minutely bidentate.

High montane, 7000 to 11,000 ft.: coastal Southern California; White Mts.; Sierra Nevada from Tulare Co. to Nevada Co. East to western Nevada.

Locs.—Southern California: San Jacinto Mts., *Hasse;* Mt. San Gorgonio, *Geo. B. Grant* 6404. White Mts., *Jepson* 7345. Sierra Nevada: Lone Pine, *M. E. Jones;* Mt. Whitney, *Jepson* 5053; upper San Joaquin River, *Congdon;* Yosemite, *Congdon;* Tuolumne Mdws., *Jepson* 4475; Calaveras Big Trees, *Hillebrand* 2307; Sonora Pass, *A. L. Grant* 142, 277, 297; Silver Valley, Alpine Co., *Brewer* 1967; Donner Pass, *Torrey* 549.

Refs.—Carex heteroneura W. Boott in Bot. Cal. 2:239 (1880), type loc. Lake Tahoe to Bear Valley, *Kellogg;* Mackenzie, Erythea 8:71, fig. 39 (1922). *C. atrata* W. Boott l.c. not L. *C. atrata* L. var. *erecta* W. Boott l.c.; Kuk. in Engler, Pflzr. 4^{20}:399 (1909), type from Cal., but not otherwise given. *C. quadrifida* Bailey, Proc. Cal. Acad. ser. 2, 3:104 (1891), type loc. Mt. Dana, *Bolander* 5046, and var. *lenis* Bailey, l.c. 3:105 (1891), also based on *Bolander* 5046. *C. quadrifida* Bailey var. *caeca* Bailey, Bot. Gaz. 21:8 (1896), type from Tahquitz Valley, San Jacinto Mts., *Hasse*. *C. atrata* L. subsp. *atratiformis* Brit. f. *caeca* Kük. l.c. 400.

98. **C. albo-nigra** Mackenzie. Culms 1 to 3 dm. high; leaf-blades 2.5 to 5 mm. wide; spikes usually 3, closely approximate, sessile or very nearly so, linear-oblong, about 1 cm. long, closely flowered with 15 to 20 appressed-ascending perigynia; scales ovate, acutish, purplish-black usually with strongly developed white margins; perigynia obovate, strongly flattened, 3 to 3.5 mm. long, substipitate, abruptly beaked, the beak 0.25 mm. long, minutely bidentate; achenes narrower than perigynia, short-stipitate.

Dry mountain sides, high Sierra Nevada in Tulare Co. (Glacier Lake, Dudley 1699). East to Arizona and Colorado.

Ref.—Carex albo-nigra Mackenzie in Rydb. Fl. Rocky Mts. 137 (1917), type from Needle Mt., Wyo., *M. Cary* 613.

99. **C. mertensii** Prescott. Culms 3 to 10 dm. high, very sharply triangular, rough; leaf-blades 4 to 7 mm. wide; spikes 1 to 4 cm. long, the upper approximate, the lower more remote on slender peduncles; scales lance-ovate, acute; perigynia appressed, broadly oval, much flattened, purple-spotted, tapering at apex, minutely beaked, the beak 0.5 mm. long, entire; achenes strongly stipitate.

Mountains, Trinity Co. (North Fork Coffee Creek, Goldsmith 20). A well marked and handsome species abundant farther north. Extending to Alaska and Montana.

Ref.—Carex mertensii Prescott, Mem. Acad. St. Petersb. ser. 2, 6:168 (1833), type loc. Sitka, Alas.

Sect. 28. Acutae Fries. Culms leafy below, aphyllopodic or phyllopodic. Terminal 1 to several spikes staminate (rarely gynaecandrous), linear, the others pistillate, linear to cylindric or oblong, closely many-flowered, sessile or peduncled. Bracts sheathless or rarely short-sheathing, leafy or squamiform, often bi-auriculate and darkened at base. Perigynia membranaceous to coriaceous, plano- or bi-convex or turgid, elliptic to obovate, puncticulate, margined, beakless or abruptly minutely beaked, the orifice entire to deeply bidentate. Achenes normally lenticular. Stigmas normally 2.

100. **C. scopulorum** Holm. Culms 1 to 4 dm. high, stiff, sharply triangular, smooth; leaf-blades 3 to 7 mm. wide with revolute margins; terminal spike staminate or androgynous; lateral spikes 2 or 3, approximate, erect, sessile or short-stalked, pistillate or androgynous, 1 to 2.5 cm. long, 6 to 7 mm. wide; perigynia 2.5 to 3.5 mm. long, soon turgid, papillose, spreading, nerveless, with short but prominent entire beak.

Sierra Nevada in Tulare Co. (nw. of Whitney Mdws., Coville & Funston 1706). North to Washington, east to Colorado.

Refs.—CAREX SCOPULORUM Holm, Am. Jour. Sci. ser. 4, 14:421, f. 1–6, and 422 (1902), type loc. Clear Creek Cañon, Colo., *Holm*; Kük. in Engler, Pflzr. 4^{20}:303, fig. 46F (1909).

101. **C. gymnoclada** Holm. Culms sharply triangular, usually roughened above, developing some short blades the first year and in the flowering (second) year 2 to 4 erect blades, 2.5 to 4 mm. wide, flat with revolute margins; staminate spike short-peduncled, 5 to 15 mm. long; pistillate spikes 2 or 3, approximate, oblong or linear-oblong, 5 to 25 mm. long; perigynia appressed, obovoid, plano-convex, not turgid, 3 mm. long, often dark tinged, nerveless, granular, the beak straight, 0.25 mm. long.

High montane, 6000 to 9000 ft., Sierra Nevada from Tulare Co. to Siskiyou Co., thence west to Trinity Co. North to Washington, east to Colorado.

Locs.—Olancha Mt., *Hall & Babcock* 5248; Alta Mdws., Tulare Co., *Geo. B. Grant*; Crescent Lake, Mariposa Co., *Congdon*; Sonora Pass, *A. L. Grant* 267, 389, 411; Silver Mt., *Brewer* 2015; Strawberry Creek, Eldorado Co., *Brainerd*; Mt. Eddy, *Eggleston* 11569; Bally Mt., near Shasta City, *Brewer* 1458.

Refs.—CAREX GYMNOCLADA Holm, Am. Jour. Sci. ser. 4, 14:424 f. 12–14 (1902), type loc. Hurricane Creek, Ore., *Cusick*; Mackenzie, Erythea 8:73, fig. 40 (1922). *C. vulgaris* Fries var. *alpina* W. Boott in Bot. Cal. 2:240 (1880), not F. Boott. *C. vulgaris* Fries var. *bracteosa* Bailey, Proc. Am. Acad. 22:81 (1886), type from Ebbetts Pass, *Brewer* 2015.

102. **C. nebraskensis** Dew. (Fig. 34d-f.) Culms 2.5 to 10 dm. high, stout, rigid; leaf-blades pale green, 3 to 8 mm. wide, flat, the sheaths nodulose; staminate spikes 1 or 2, peduncled, 1.5 to 3.5 cm. long; pistillate spikes 2 to 5, oblong, sessile or short-peduncled, 1.5 to 6 cm. long, contiguous or the lower separate, with very many ascending perigynia; scales lanceolate, blackish; perigynia ascending, 3 to 3.5 mm. long, greenish straw color, compressed bi-convex, ribbed.

Meadows and swamps, 4000 to 9700 ft.: mountains of coastal Southern California; Sierra Nevada from Tulare Co. to Siskiyou Co.; Panamint Mts. North to British Columbia, east to Kansas.

Locs.—Southern California: San Jacinto Mts., *Hall* 2484; Bear Valley, San Bernardino Mts., *Abrams* 2925 (in part); Mt. Pinos, *Hall* 6519. Inyo Co.: Panamint Cañon, Panamint Mts., *Hall & Chandler* 7039; Lone Pine, *Jepson* 5154. Sierra Nevada: Huckleberry Mdw., Kaweah River, *Hopping* 465; Grant Park, *Dudley* 1204; Sonora Pass, *A. L. Grant* 390; Tallac, *Brainerd* 59; Jess Valley, Modoc Co., *Griffiths & Hunter* 432; McCloud, *Dudley*.

Refs.—CAREX NEBRASKENSIS Dew. Am. Jour. Sci. ser. 2, 18:102 (1854), type from Nebr., *Hayden*; Mackenzie, Erythea 8:73, fig. 41 (1922). *C. jacintoensis* Parish, Bull. S. Cal. Acad. 4:110, pl. 16 (1905), type loc. San Jacinto Mts., *Hall* 2483.

103. **C. paucicostata** Mackenzie. Culms slender, 2.5 to 4 dm. high; leaf-blades light green, 2 to 4 mm. wide, flat or channeled at base; staminate spike solitary; pistillate spikes 4 to 6, linear, 1 to 4 cm. long, the numerous perigynia appressed-ascending; scales oblong, obtuse or acutish, blackish with lighter center; perigynia 2 mm. long, glaucous-green, the upper empty part inconspicuous, abruptly black apiculate tipped.

Wet places, mostly around lakes, Sierra Nevada from Tulare Co. to Nevada Co., 5000 to 7200 ft.

Locs.—Kern Lake, *Dudley* 2044; South Fork San Joaquin River, *Hall & Chandler* 651; Crescent Lake, Mariposa Co., *Congdon;* Yosemite, *Bolander* 6198; Lake Mary, Mono Co., *Congdon;* Silver Lake, Amador Co., *Brewer* 2099; Truckee, *Hitchcock* 258.

Refs.—CAREX PAUCICOSTATA Mackenzie, Erythea 8:74 (1922). *C. interrupta* Boeckl. var. *impressa* Bailey, Mem. Torr. Club 1:18 (1889), type loc. Summit Camp, Placer Co., *Kellogg.* *C. lenticularis* Boott in Bot. Cal. 2:242 (1880) in part, not Michx.

104. **C. hindsii** C. B. Clarke. Culms slender, 1 to 6 dm. high; blades 1.5 to 3 mm. wide, flat or channeled at base; staminate spike solitary, long-peduncled; pistillate spikes 4 to 6, linear or oblong-linear, 1.5 to 4.5 cm. long, the numerous perigynia appressed-ascending; scales oblong, obtuse or acutish, blackish with lighter center, much shorter than perigynia; perigynia 2.5 to 3.5 mm. long, the upper part empty, abruptly black apiculate tipped.

Wet places along the coast, Del Norte Co. (Crescent City, W. R. Dudley). North to the Aleutian Isls.

Ref.—CAREX HINDSII C. B. Clarke, Kew. Bull. Misc. Inf. add. ser. 8:70 (1908), type loc. Columbia River, *Hinds.*

105. **C. kelloggii** W. Boott. Culms slender, 3 to 7 dm. high; leaf-blades light green, flat or channeled at base, 1.5 to 3 mm. wide; staminate spike usually solitary; pistillate spikes 3 to 5, sessile or nearly so, approximate, linear, 1.5 to 4 cm. long, often attenuate at base, the numerous perigynia appressed-ascending; scales obtuse or acutish with broad light-colored center; perigynia 2.5 mm. long, the beak abruptly black apiculate tipped.

Wet places, 4000 to 9400 ft., Sierra Nevada from Tulare Co. to Siskiyou Co. North to Alaska, east to Colorado.

Locs.—Moraine Lake, Chagoopah Plateau, *Dudley* 2211; Giant Forest, *Dudley* 2989; North Fork, Fresno Co., *Griffiths* 4572; Johnson Lake, Yosemite Park, *Congdon;* Snowy Cascade, Eldorado Co., *Brainerd* 77; Jacksons Lake, Siskiyou Co., *Dudley.*

Refs.—CAREX KELLOGGII W. Boott in Bot. Cal. 2:240 (1880), type loc. "Alta and from Lake Tahoe to Bear Valley," *Kellogg, Lemmon.* *C. decidua* W. Boott, l.c. 241, not F. Boott. *C. lenticularis* W. Boott, l.c. 242 in part, not Michx.

106. **C. sitchensis** Prescott. Culms 6 to 12 dm. high, stout, sharply triangular, strongly reddened at base; leaf-blades flat or channeled at base, 2 to 9 mm. wide; staminate spikes 2 to 5, slender; pistillate spikes 3 to 5, strongly separate, linear-cylindric, 3 to 9 cm. long, very many-flowered; scales lanceolate, sharp-pointed; perigynia ovate or oval, 3 to 3.5 mm. long, broadest near middle, not red-dotted, apiculate.

Near the coast from Santa Cruz Co. to Del Norte Co., thence easterly to Butte Co. North to Alaska. Very local with us.

Locs.—Santa Cruz, *Wood* 599; Twelve Mile House near San Jose, *Bolander;* Crescent City, *Dudley;* Sisson, *Jepson* 55a; Clear Creek, Butte Co., *H. E. Brown* 91.

Refs.—CAREX SITCHENSIS Prescott, Mem. Acad. St. Petersb. ser. 6, 2:169 (1832), type loc. Sitka, Alas. *C. aquatilis* W. Boott in Bot. Cal. 2:241 (1880), not Wahl.

107. **C. aquatilis** Wahl. Culms 2 to 7 dm. high, reddened at base; leaf-blades 2 to 6 mm. wide; staminate spikes 1 or 2, slender; pistillate spikes 2 to 4, sessile or short-peduncled, not aggregated, linear, 1.5 to 6 cm. long; scales oblong-obovate to lanceolate, obtuse or acutish; perigynia elliptic-obovoid, 2.5 mm. long, broadest below apex, red-dotted, minutely beaked.

Swampy grounds, Modoc Co. (Moulton, Warner Mts., Griffiths & Hunter 474). North to Alaska, east to Quebec.

Refs.—CAREX AQUATILIS Wahl. in Vet. Akad. Nya. Handl. Stockholm 24:165 (1803), type loc. Lapland; Kük. in Engler, Pflzr. 4^{20}:309, fig. 48A-D (1909), not *C. aquatilis* W. Boott in Bot. Cal. 2:241 (1880).

108. **C. barbarae** Dew. Culms 3 to 10 dm. high, stout, sharply triangular, serrulate at least in inflorescence; leaves 7 to 12, the sheaths brownish-puberulent, the blades light-green, thick, flat or channeled, 3.5 to 9 mm. wide, serrulate, the middle ones much reduced, filamentose; staminate spikes 1 or 2, narrowly linear; pistillate spikes 2 to 5, sessile or short-peduncled, oblong- or linear-cylindric, 2.5 to 8 cm. long, reddish-purple with lighter center; perigynia ascending, oval, obscurely nerved, 3 to 4.5 mm. long, at length brownish, often granular.

Mountains of coastal Southern California, Sierra Nevada foothills, Great Valley, and Coast Ranges. One of the most characteristic California species from about 20 to 4000 ft. North to Oregon.

Locs.—Southern California: Jamacha, *Chandler* 5262; Waterman Cañon, San Bernardino Mts., *Parish* 1053; Pasadena, *McClatchie;* Santa Barbara, *Parry.* Sierra Nevada and Great Valley: Kern Cañon, *Heller* 7773; Visalia, *Abrams* 5382; Kings River, *Dudley;* Marysville, *Wooton;* Mule Creek, Ione, *Braunton* 1093. Coast Ranges: Arroyo Seco, Santa Lucia Mts., *Brewer* 683; Berkeley Hills, *Jepson* 4172; Mt. Diablo, *Abrams* 5723; Mark West Creek, *Bolander;* Clear Lake, *Bolander* 2609; Ukiah, *Barrett;* Sisson, *Jepson* 57a.

Refs.—CAREX BARBARAE Dew. Bot. Mex. Bound. 231 (1858), type loc. Santa Barbara, *Parry;* Mackenzie, Erythea 8:77, fig. 42 (1922). *C. laciniata* Boott in Benth. Pl. Hartw. 341 (1857), name only; Ill. Car. 4:175, pl. 594 (1867) in part, type from banks of the Sacramento, *Hartweg* 2022. *C. wilkesii* Olney, Bot. Wilkes Exped. 2:477, pl. 17 (1874), type from banks of the Sacramento, *Wilkes.* *C. lacunarum* Holm, Am. Jour. Sci. ser. 4, 17:303, f. 12 13 (1904), type from Sebastopol, *Heller* 5797. *C. magnifica* Dew. var. *lacunarum* Kük. in Engler, Pflzr. 4^{20}:366 (1909). *C. nudata* var. *anomala* Kük. l.c. 337, as to Cal. spms. *C. prescottiana* Olney in Bot. King 369 (1871) in part.

109. **C. schottii** Dew. Culms 10 to 15 dm. high, sharply triangular, very rough above; leaf-blades flat with revolute margins, serrulate, the lower sheaths hispidulous dorsally; staminate spikes about 3, elongate-linear, 8 to 14 cm. long; pistillate spikes mostly 3, sessile or nearly so, elongate-linear, 11 to 14 cm. long; scales narrowly lanceolate, acute or obtusish, purplish-black with broad 3-ribbed lighter center; perigynia appressed plano-convex, obovate, 3 mm. long, greenish straw-colored, strongly several-nerved on both faces, the beak 0.25 mm. long.

Coastal Southern California and north to Monterey Co., 20 to 2500 ft.

Locs.—Santa Ana, *Geis;* Waterman Cañon, San Bernardino Mts., *Parish* 2144; Pasadena, *Geo. B. Grant* 137; Castroville, *Elmer* 4386.

Refs.—CAREX SCHOTTII Dew. Bot. Mex. Bound. 231 (1858), type loc. Santa Barbara, *Parry.* *C. barbarae* Parish, Bull. S. Cal. Acad. 4:108, pl. 14 (1905), not Dew.

110. **C. senta** Boott. Culms 4 to 9 dm. high, sharply triangular; leaves 6 to 12, the middle sheaths sparingly hispidulous dorsally and filamentose ventrally, the blades 3 to 5 mm. wide, the middle ones much reduced; terminal spike staminate, peduncled, 3 to 4.5 cm. long, with 1 or 2 smaller ones at base; pistillate spikes 1 to 3, sessile or short-peduncled, 2.5 to 5 cm. long; scales oblong-ovate or lanceolate, obtuse to acuminate, purplish-black with lighter center; perigynia ovate, conspicuously several-nerved on both faces, green or straw-colored, often dark-tinged and frequently strongly red-dotted, granular, the beak 0.25 mm. long.

Coastal counties from Alameda Co. to San Diego Co.; Sierra Nevada from Amador Co. to Tulare Co. East to Arizona.

Locs.—Coast Ranges: Oakland, *Bolander* 1566d; Stanford, *Schofield;* Nacimiento Creek, Monterey Co., *Dudley.* Sierra Nevada: Amador Co., *Hansen* 636; Mariposa, *Congdon;* Giant Forest, *Dudley* 2996. Southern California: Santa Paula, *Cobb* 135; Los Angeles, *Bigelow;* San Jacinto Mts., *Reed* 2558; Laguna, San Diego Co., *Schoenefeldt* 3594.

Refs.—CAREX SENTA Boott, Ill. Car. 4:174 (1867), type loc. Santa Inez Mts., *Brewer* 350. *C. auriculata* Bailey, Mem. Torr. Club 1:19 (1889), type loc. Coloma, *Andersson.* *C. austromontana* Parish, Bull. S. Cal. Acad. 4:108, pl. 15 (1905), type loc. San Bernardino Mts., *Parish* 2485. *C. jamesii* W. Boott in Bot. Cal. 2:243 (1880) in small part, not Torr. *C. bishallii* C. B. Clarke, Kew Bull. Misc. Inf. Add. ser. 8:70 (1908), type from Yosemite, *Brewer* 1648. *C. nudata* W. Boott, f. *sessiliflora* Kuk. in Engler, Pflzr. 4^{20}:337 (1909), type from Amador Co., *Hansen* 636. *C. nudata* Kuk. l.c. in part, not W. Boott. *C. jamesii* var. *austromontana* Kük. l.c. 318. *C. jamesii* var. W. Boott in Bot. Cal. 2:243 (1880). *C. angustata* W. Boott, l.c. 242 in part, not F. Boott.

111. **C. nudata** W. Boott. Culms slender, 3 to 8 dm. high, sharply triangular, strongly dark purplish at base; leaf-blades light green, flat with revolute margins, 2.5 to 3.5 mm. wide, smooth except toward apex, the basal sheaths rounded and hispidulous dorsally; staminate spike short-peduncled, 1.5 to 3 cm. long; lateral spikes 3 to 5, sessile or short-peduncled, 1 to 4 cm. long, 6 to 7 mm. wide; bracts conspicuously bi-auriculate; scales ovate, or oblong-ovate, obtuse or acutish, blackish with lighter midvein; perigynia lanceolate or ovate, compressed biconvex, 3 to 4 mm. long, finely 6 to 9-nerved on both faces, membranaceous, greenish straw-color or purplish-black tinged, smooth or slightly granular at apex, the upper portion empty, the beak 0.25 mm. long, entire.

Rocky beds of streams, 10 to 2000 ft.: Coast Ranges from Santa Clara Co. to Siskiyou Co.; Sierra Nevada from Calaveras Co. to Shasta Co. North to western Oregon.

Locs.—Coast Ranges: Loma Prieta, *Davy* 572; Oakland Slough, *Bolander* 6202; Marin Co., *Bolander* 2299; Russian River, Sonoma Co., *Bolander* 3856; High Valley Creek, Lake Co., *Bowman* 111; Ukiah, *Bolander* 3836; Alder Point, Humboldt Co., *Tracy* 1885; Castle Rock, Sacramento River, *Goldsmith* 3. Sierra Nevada: Calaveras Big Trees, *Dudley;* Clinton, Amador Co., *Hansen* 1658; Stirling, Butte Co., *Heller* 10818; Burney Falls, Shasta Co., *Dudley.*

Refs.—Carex nudata W. Boott in Bot. Cal. 2:241 (1880), based on spms. from the Coast Ranges between San Francisco Bay and Ukiah, *Bolander* 2299, 3836, 4638, 6202. "*C. decidua*" Boott in Pac. R. Rep. 4:153 (1857). *C. angustata* W. Boott, l.c. 242 in part, not F. Boott.

112. **C. eurycarpa** Holm. Culms 4 to 9 dm. high, sharply triangular, roughened above; leaf-blades 3 to 4.5 mm. wide, the lower sheaths minutely hispidulous and rounded dorsally; staminate spike peduncled, 3 to 4 cm. long; lateral spikes 3 to 5, 2 to 4 cm. long; scales lanceolate, short-acuminate, purplish-brown with prominent light midvein; perigynia appressed, 2.75 mm. long, several-nerved on both faces, minutely roughened, greenish or straw-color, the beak 0.5 mm. long, emarginate.

Boggy meadows, Sierra Nevada from Mariposa Co. to Siskiyou Co. North to Washington.

Locs.—Devils Lake, Mariposa Co., *Congdon;* Tallac, *Brainerd* 46; Squaw Valley, Placer Co., *L. S. Smith* 559; Prattville, *Heller & Kennedy* 8784; Sisson, *L. E. Smith* 691.

Ref.—Carex eurycarpa Holm, Am. Jour. Sci. ser. 4, 20:303 (1905), type loc. Falcon Valley, w. Klickitat Co., Wash., *Suksdorf* 1284, 2962.

113. **C. oxycarpa** Holm. Culms 4.5 to 9 dm. high, sharply triangular, slightly roughened above; leaf-blades 2 to 4 mm. wide, the lower sheaths hispidulous dorsally; terminal spike staminate, peduncled; lateral spikes 4 or 5, the upper 1 or 2 staminate, the lower 2 to 4 pistillate or androgynous, sessile or short-peduncled, 2.5 to 4.5 cm. long, 5 mm. wide; scales lanceolate, acute, purplish-black with light midvein; perigynia 3.5 mm. long, 3 to 5-striate on both faces, granular roughened, brownish, abruptly minutely apiculate, the orifice entire.

Wet meadows, northern Sierra Nevada from Butte Co. to Siskiyou Co. North to Washington and Idaho.

Locs.—Jonesville, Butte Co., *Hall* 9783; Morgan, Tehama Co., *Hall & Babcock* 4347; Sisson, *Brainerd.*

Ref.—Carex oxycarpa Holm, Am. Jour. Sci. ser. 4, 20:303 (1905), type loc. w. Klickitat Co., Wash., *Suksdorf* 816.

Sect. 29. Cryptocarpae Tuckerm. Stoloniferous. Culms aphyllopodic or phyllopodic. Terminal 1 to 3 spikes staminate, linear, the others pistillate, linear or oblong, closely many-flowered, the lower or all peduncled and erect or very often pendulous. Bracts sheathless, the upper at least biauriculate at base. Scales 3-nerved, usually cuspidate or aristate, but in some species obtuse. Perigynia coriaceous or membranaceous, plano- or bi-convex or turgid, elliptic to obovate, puncticulate, margined, abruptly minutely beaked or beakless, the orifice entire or nearly so. Achenes lenticular, apiculate, constricted in the middle. Stigmas 2.

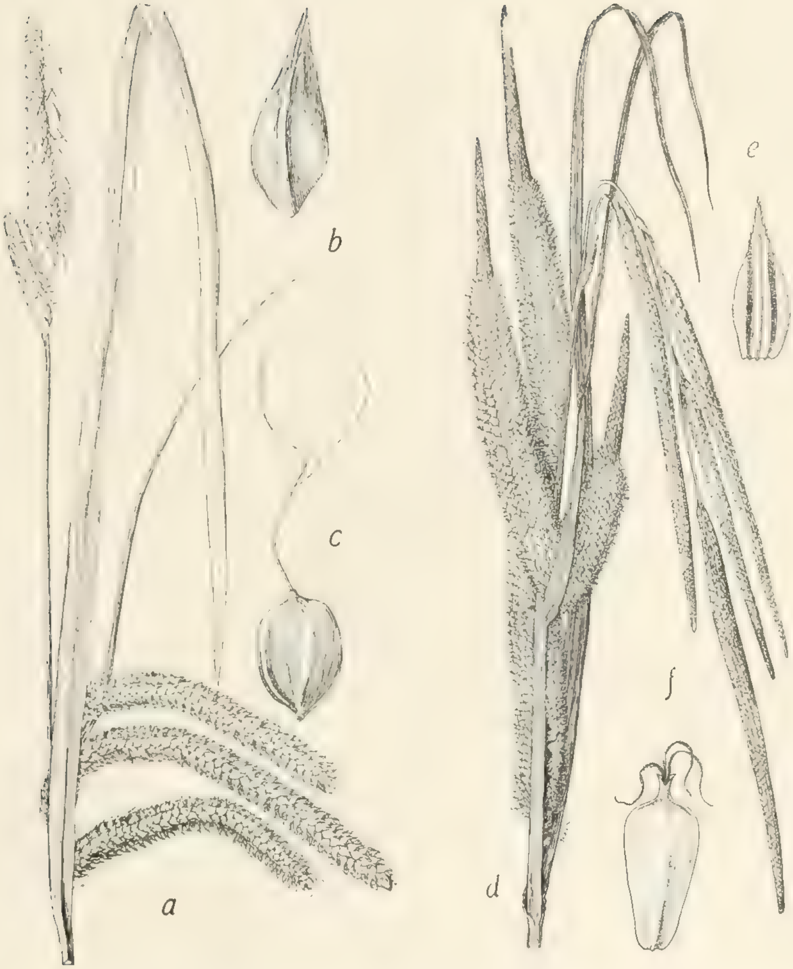

Fig. 35. *a*, Carex obnupta Bailey, inflorescence, × ⅔; *b*, scale, × 5; *c*, perigynium, × 5. *d*, C. spissa Bailey, inflorescence, × ⅔; *e*, scale, × 6; *f*, perigynium, × 6.

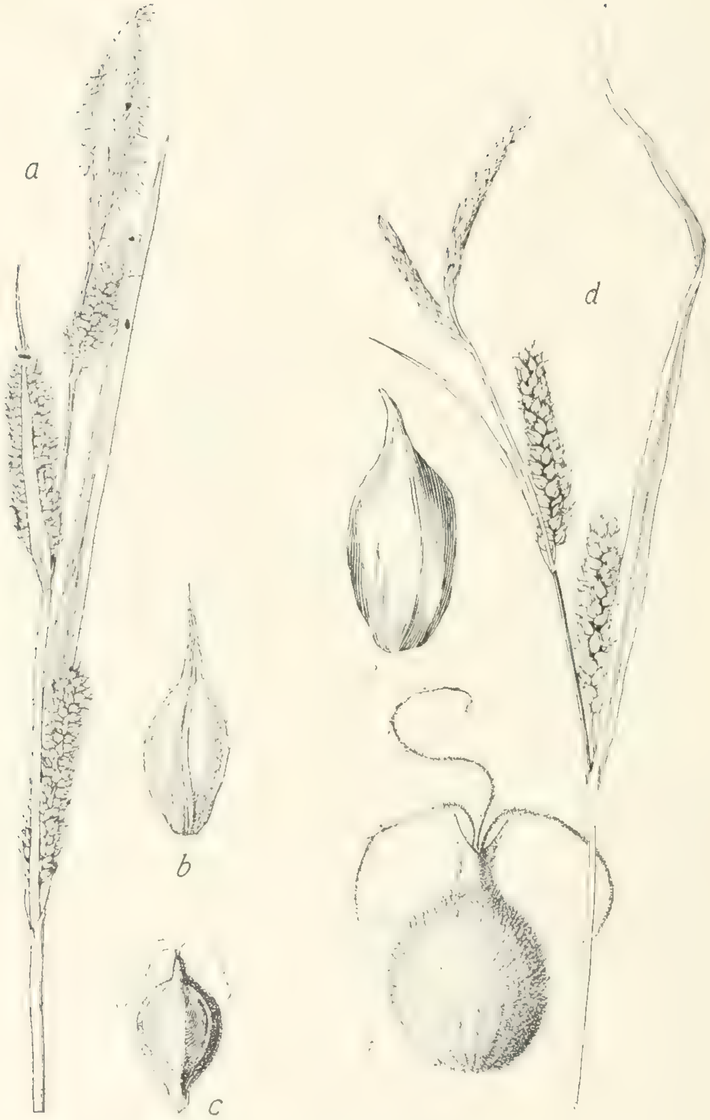

Fig. 36. *a*, CAREX YOSEMITANA Bailey, inflorescence, × 1; *b*, scale, × 7; *c*, perigynium, × 7. *d*, C. LANUGINOSA Michx., inflorescence, × 1; *e*, scale, × 10; *f*, perigynium, × 10.

114. **C. lyngbyei** Hornem. Culms 3 to 9 dm. high; leaf-blades flat, 2 to 12 mm. wide; uppermost spike staminate, long-peduneled; lateral spikes 2 to 6, the upper 1 or 2 often staminate or androgynous, the lower pistillate, drooping, linear or oblong, 2 to 8 cm. long; perigynia oblong-oval, bi-convex, 2.5 to 3 mm. long, very minutely beaked.

Humboldt Co. coast (Humboldt Bay, Tracy 3149). North to the Aleutian Isls. Widely distributed in Arctic regions.

Ref.—CAREX LYNGBYEI Hornem. Fl. Dan. pl. 1888 (1827), type from Faroe Isls., Eur.

115. **C. obnupta** Bailey. (Fig. 35a-c.) Culms 5 to 15 dm. high; leaf-blades 5 to 8 mm. wide, thick; staminate spikes 2 or 3, pistillate spikes 2 to 4, oblong to linear-cylindric, 3 to 10 cm. long, strongly peduncled; scales narrowly ovate, blackish, sharp-pointed, concealing perigynia; perigynia coriaceous, 3 to 3.5 mm. long, abruptly minutely beaked, the beak entire.

Coastal counties from Monterey Co. to Del Norte Co. and local in the Sacramento Valley. North to British Columbia.

Locs.—Santa Lucia Mts., *Plaskett* 42; Santa Cruz, *Dudley;* Berkeley, *Davy;* Abbotts Lagoon, Pt. Reyes, *Jepson* 1170; Sebastopol, *Congdon;* Sycamore Slough, Colusa Co., *Ferris* 607; Mendocino, *Pringle;* Humboldt Bay, *Tracy* 2459; Crescent City, *Dudley.*

Refs.—CAREX OBNUPTA Bailey, Proc. Cal. Acad. ser. 2, 3:104 (1891), type loc. San Mateo Co., *Kellogg;* Mackenzie, Erythea 8:81, fig. 43 (1922). *C. aquatilis* W. Boott in Bot. Cal. 2:241 (1880), not Wahl. *C. sitchensis* Boott in Hook. Fl. Bor. Am. 2:220, pl. 221 (1840), not Prescott. *C. schottii* Kük. in Engler, Pflzr. 4^{20}:365 (1909), not Dew.

Sect. 30. Trachychlaenae Drejer. Phyllopodic. Culms very stout, leafy below, the lower sheaths strongly filamentose ventrally. Spikes numerous, the upper 3 to 6 staminate, elongated, the lower 3 to 6 pistillate (or staminate at apex), linear-cylindric. densely very many-flowered, the lower at least long-peduncled. Lowest bract about equaling or exceeding the inflorescence, short sheathing. Pistillate scales mucronate or aristate. Perigynia obovoid or oblong, glabrous, roughened or hispidulous, membranaceous, slightly inflated, apiculate-beaked, the orifice emarginate. Achene triangular, the sides flat or slightly concave. Stigmas 3.

116. **C. spissa** Bailey. (Fig. 35d-f.) Rootstocks stout, woody; culms 1 to 2 m. high, obtusely triangular, smooth; leaf-blades glaucous-green, 7 to 14 mm. wide, flat with revolute strongly serrulate margins, the sheaths brownish tinged; pistillate spikes separate, erect, sessile or nearly so, 6 to 14 cm. long, the perigynia squamose at maturity; scales narrowly ovate, serrulate-awned, light brownish; perigynia 3 to 4.5 mm. long, becoming somewhat inflated, very abruptly beaked, the beak 0.5 mm. long, the style very strongly bent and twisted; achenes elliptic-obovoid.

Banks of streams at low altitudes from Los Angeles Co. to San Diego Co. South to Lower California.

Locs.—Glendale, *Hasse;* Mt. Wilson, *Davidson;* Tecate River, *Mearns* 3787; Lakeside, *Brandegee.*

Refs.—CAREX SPISSA Bailey, Proc. Am. Acad. 22:70 (1886), type loc. San Diego Co., *Pringle;* Mackenzie, Erythea 8:83, fig. 44 (1922).

Sect. 31. Hirtae Tuckerm. Culms stout, leafy. Rootstocks with long stolons. Leaves septate-nodulose. Spikes 3 to 10, the upper 1 to 5 staminate, slender, the others pistillate, many-flowered, erect. Bracts leaflike, equaling or exceeding the culm, often sheathing. Pistillate scales ovate or lanceolate, acute or aristate. Perigynia mostly ascending, coriaceous, ovoid or oblong-ovoid, somewhat inflated, nearly orbicular in cross-section, many-nerved, often hairy, round-tapering at base, tapering into the bidentate beak. Achenes triangular, often stipitate, the sides flat or deeply concave, apiculate. Stigmas 3.

117. **C. yosemitana** Bailey. (Fig. 36a-c.) Cespitose from stout rootstocks; culms 3 to 9 dm. high; leaf-blades not rigid, 3 to 7 mm. wide; terminal spike linear, 12 to 30 mm. long, more or less peduncled, occasionally with a few perigynia; pistillate spikes 3 or 4, more or less separate, sessile or nearly so, oblong-cylindric, 1 to 4 cm. long, closely flowered, often staminate at apex; scales lance-ovate, sharp-pointed, ciliate, chestnut-brown; perigynia 2.5 to 3.5 mm. long,

obovoid, or oblong-obovoid, obscurely nerved, abruptly short-beaked, the beak 0.5 mm. long.

Montane, 4000 to 8000 ft.: Sierra Nevada from Tuolumne Co. to Tulare Co.; San Jacinto Mts.

Locs. Little Yosemite, *Jepson* 4395; Dunlap, *Griffiths* 4682; Mt. Silliman, *Dudley* 1504; San Jacinto Mts., *Parish* 1574.

Refs.—CAREX YOSEMITANA Bailey, Mem. Torr. Club 1:8 (1889); Mackenzie, Erythea 8:83, fig. 45 (1922). *C. sartwelliana* Olney, Proc. Am. Acad. 7:396 (1868), type loc. Yosemite Valley, *Brewer* 1636, not *C. sartwellii* Dew. 1842. *C. congdonii* Bailey, Bot. Gaz. 21:6 (1896), type loc. Mt. Warren Pass, Tuolumne Co., *Congdon*.

118. **C. oregonensis** Olney. Rootstocks slender, woody, creeping; culms 1 to 5 dm. high, rigid, smooth; leaf-blades thick, rigid, 3 to 5 mm. wide, canaliculate, mostly exceeding culms; terminal 2 or 3 spikes staminate, linear, 8 to 25 mm. long; pistillate spikes 3 or 4, 1.5 to 5 cm. long, the lower more or less separate, closely erect, closely flowered above or loosely below, the perigynia appressed ascending; scales ovate, acute to cuspidate, chestnut brown tinged; perigynia ovoid, obtusely triangular, 4 to 5 mm. long.

Mountain meadows, Siskiyou Co. (Medicine Lake, Goldsmith 29, 29a). North to Washington.

Refs.—CAREX OREGONENSIS Olney, Proc. Am. Acad. 8:407 (1872), type from Ore., *Hall;* Bailey, Proc. Am. Acad. 22:73 (1886); Kük. in Engler, Pflzr. 4^{20}:745, fig. 127 (1909); Mackenzie, Erythea 8:84, fig. 46 (1922). *C. halliana* Bailey, Bot. Gaz. 9:117 (1884), type from Ore., *Hall,* not. C. hallii Olney (1871).

119. **C. lanuginosa** Michx. (Fig. 36d-f.) Culms 3 to 10 dm. high, sharp-angled and rough above; leaf-blades flat, 1.5 to 5 mm. wide, rough; staminate spikes 1 to 3, up to 3 cm. long, distant; pistillate spikes 1 to 3, oblong-cylindric, 1 to 5 cm. long, sessile or short-peduncled, closely flowered; scales lanceolate, acuminate or aristate, reddish-brown tinged; perigynia broadly ovoid, 2.5 to 3.5 mm. long, the nerves obscure.

Wet meadows or swamps in the valleys and mountains, 500 to 8000 ft.: coastal Southern California; western Mohave Desert; upper San Joaquin Valley; Sierra Nevada from Tulare Co. to Siskiyou Co. North to British Columbia, east to Nova Scotia.

Locs.—Southern California: Santa Ana, *Geis* 559; El Monte, Los Angeles, *Johnston;* San Bernardino Valley, *Parish* 1052; Victorville, *Parish* 9705. Greenfield, Kern Co., *Davy* 1830. Sierra Nevada: Mt. Whitney, *Dudley* 2509; Snow Creek, Yosemite, *Congdon;* Kennedy Mdw., Tuolumne Co., *A. L. Grant* 222a; Lake Tahoe, *L. S. Smith* 640; Jess Valley to Blue Lake, *Griffiths & Hunter* 426; Sisson, *Jepson* 5792.

Refs.—CAREX LANUGINOSA Michx. Fl. Bor. Am. 2:175 (1803), type loc. Lake Mistassins, Canada; Mackenzie, Erythea 8:85, fig. 47 (1922). *C. acmato-rhyncha* Olney in Bot. King 373 (1871), not Desv. *C. filiformis* L. var. *latifolia* Boeckl. Linnaea 41:309 (1877), based primarily on *C. lanuginosa* Michx. *C. filiformis* L. var. *acmatorhyncha* W. Boott in Bot. Cal. 2:250 (1880). *C. lasiocarpa* Ehrb. var. *lanuginosa* Kük. in Engler, Pflzr. 4^{20}:748 (1909). *C. watsoni* Olney l.c. 370, type loc. Carson City, Nev., *Watson* 1246.

120. **C. sheldonii** Mackenzie. Culms very smooth below the spikes, 5 to 10 dm. high, not fibrillose at the base; leaf-blades 3.5 to 6 mm. wide, the sheaths dark-tinged at the mouth, the basal breaking and slightly filamentose; staminate spikes 2 or 3, distant; pistillate spikes usually 2, 2 to 5 cm. long, rather closely flowered; scales ovate-lanceolate, acuminate or cuspidate; perigynia 5 to 6 mm. long.

Swamps, Warner Mts., northeastern California (Jess Valley to Blue Lake, Griffiths & Hunter 429). North to Oregon, east to Idaho.

Ref.—CAREX SHELDONII Mackenzie, Bull. Torr. Club 42:618 (1915), type loc. Clarks Creek, Ore., *Sheldon* 8854.

Sect. 32. Extensae Fries. Culms slender but strict, obtusely triangular, leafy toward base. Leaves sparingly septate-nodulose, the blades narrow. Spikes 2 to 10, the terminal usually staminate, the others pistillate, suborbicular to oblong, densely flowered, 3 cm. or less long, the upper sessile and approximate, the lower remote, peduncled, erect. Bracts leafy, more or less sheathing. Pistillate scales ovate, mostly reddish, copper or chestnut tinged. Perigynia ascending, spreading or deflexed, membranaceous, smooth, many nerved, somewhat inflated, obscurely triangular, rounded at base, contracted into a bidentate beak, the teeth very erect. Achenes triangular with flat sides. Stigmas 3.

121. **C. viridula** Michx. Densely cespitose, the culms 0.6 to 3 dm. high, smooth; leaf-blades 1 to 3 mm. wide, canaliculate; staminate spike sessile or short-peduncled; pistillate spikes 2 to 6, 4 to 12 mm. long; scales ovate, much shorter than perigynia, obtuse or acutish; perigynia 2 to 3 mm. long, the beak scarcely ½ length of body.

Swamps on the Mendocino Coast (Inglenook, J. W. Congdon). North to Alaska, east to the Atlantic.

Ref.—CAREX VIRIDULA Michx. Fl. Bor. Am. 2:170 (1803), type from Canada.

Sect. 33. Physocarpae Drejer. Culms mostly tall and stout. Leaves septate-nodulose, not hairy. Spikes 2 to 10, the upper 1 to 5 staminate, the others normally pistillate, subglobose to linear-cylindric, generally closely many-flowered, erect, short-peduncled, more or less remote. Bracts leaflike, much exceeding the inflorescence, normally sheathless. Perigynia ascending, spreading or even reflexed, membranaceous, smooth, from little to much inflated, suborbicular in cross-section, coarsely many-ribbed or nerveless, contracted into a beak, the beak entire to bidentate. Achenes much shorter than perigynia, triangular or lenticular. Stigmas 3 or 2.

122. **C. vesicaria** L. Rootstocks short-creeping and stoloniferous; culms 3 to 10 dm. high, aphyllopodic, purplish-tinged at base; leaf-blades 2 to 7 mm. wide, the sheaths sparingly nodulose dorsally; staminate spikes 2 to 4, linear, 2 to 4 cm. long; pistillate spikes 1 to 3, sessile or short-peduncled, oblong-cylindric, 2.5 to 7.5 cm. long, more or less strongly separate; scales ovate-lanceolate, sharp-pointed; perigynia ovoid, yellowish-green or darker tinged.

Wet meadows and swamps: Coast Ranges from Marin Co. to Siskiyou Co., 20 to 2000 ft.; Sierra Nevada from Tulare Co. to Siskiyou Co. North to British Columbia, east to the Atlantic. Very variable.

Locs.—Coast Ranges: Tomales Bay, *Bolander* 2303; Sebastopol, *Heller* 5798; Cahto, Mendocino Co., *Bolander* 4689. Sierra Nevada: Kaweah Mdws., *Purpus* 2097; Kings River Cañon, *Dudley* 3192; Nellie Lake, Fresno Co., *A. L. Grant* 1083; Lake Mary, Mono Co., *Congdon;* Yosemite, *Jepson* 5666; Hetch-Hetchy, *Jepson* 4633, 3476; Squaw Valley, Placer Co., *L. S. Smith* 567; Prattville, Plumas Co., *Heller & Kennedy* 8818; Egg Lake, Modoc Co., *Baker;* Medicine Lake, Siskiyou Co., *Goldsmith* 27.

Refs.—CAREX VESICARIA L. Sp. Pl. 2:979 (1753), type European; Kük. in Engler, Pflzr. 4^{20}:725, fig. 124H (1909); Mackenzie, Erythea 8:87, fig. 48 (1922). *C. monile* Tuck. var. *pacifica* Bailey, Proc. Cal. Acad. ser. 2, 3:105 (1891), type loc. Yosemite, *Brewer* 1654. *C. trichocarpa* Muhl. var. *imberbis* W. Boott in Bot. Cal. 2:251 (1880), not Carey. *C. monile* W. Boott, l.c. not Tuck. *C. vesicaria* L. var. *pacifica* Kük. and var. *colorata* Kük. in Engler, Pflzr. 4^{20}:726 (1909). *C. vesicaria* L. var. *obtusisquamis* Bailey, Carex Cat. 4 (1884); Bot. Gaz. 9:121 (1884), type from Yosemite, *Brewer* 1781.

123. **C. exsiccata** Bailey. Rootstocks short-creeping; culms 3 to 10 dm. high, rough above, aphyllopodic, purplish-tinged at base; leaf-blades 3 to 7 mm. wide, the sheaths sparingly nodulose dorsally; staminate spikes 2 to 4, 2 to 4.5 cm. long, narrow; pistillate spikes 1 to 3, sessile or short-peduncled, more or less strongly separate, cylindric, 2 to 7.5 cm. long; scales lanceolate-ovate, sharp-pointed; perigynia lanceolate, olive green.

Wet places along the coast from Santa Cruz Co. to Humboldt Co. North to Alaska, east to Montana.

Locs.—Wrights, Santa Clara Co., *Dudley;* Woodside, San Mateo Co., *Dudley;* Tomales Bay, *Bigelow;* Ft. Bragg, *Mathews* 21; Eureka, *Tracy* 1194.

Refs.—CAREX EXSICCATA Bailey, Mem. Torr. Club 1:6 (1889); Mackenzie, Erythea 8:88, fig. 49 (1922). *C. vesicaria* L. var. *major* Boott in Hook. Fl. Bor. Am. 2:221 (1840), type from Columbia River, *Douglas, Scouler.*

124. **C. rostrata** Stokes. Cespitose, sending forth long horizontal stolons; culms phyllopodic, 3 to 12 dm. high; leaf-blades 2 to 12 mm. wide; staminate spikes 2 to 4, slender, 1 to 6 cm. long; pistillate spikes 2 to 5, remote, cylindric, sessile or short-peduncled, 1 to 15 cm. long; scales lanceolate, sharp-pointed; perigynia ovoid, 4 to 6 mm. long, greenish straw color or darker tinged.

Swampy places: abundant in the Sierra Nevada from Butte Co. to Tulare Co., 4000 to 6200 ft.; San Bernardino Mts.; San Francisco Bay region. North to Alaska, east to the Atlantic.

Locs.—Sierra Nevada: Chico Mdws., *Heller* 11494; Truckee, *Heller* 7108; Walker Lake, Mono Co., *Congdon;* Yosemite, *Bolander* 4968; Bishop Creek, Inyo Co., *Davidson* 2555; Grant Park, *Dudley* 1225; Little Kern Lake, Kern River Cañon, *Jepson* 4940. Bear Valley, San Bernardino Mts., *Abrams* 2850. San Francisco, *Bolander* 152.

Refs.—Carex rostrata Stokes in With. Arrang. Brit. Pl. ed. 2, 2:1059 (1787), type from Great Britain; Mackenzie, Erythea 8:89, fig. 50 (1922).

Sect. 34. Pseudo-Cypereae Tuckerm. Culms tall, generally stout, acutely angled, leafy below. Leaf-blades flat, septate-nodulose. Spikes 3 to 9, the upper 1 to 3 slender, staminate, the others normally pistillate, densely flowered, the upper approximate, the lower remote and strongly peduncled, often nodding. Bracts leaflike, much exceeding the culms, mostly not sheathing. Pistillate scales aristate. Perigynia spreading or reflexed, membranaceous or stiff, triangular or circular in cross-section, 3 to 8 mm. long, closely many-ribbed, greenish straw-color, smooth, stipitate, contracted into a rigid beak, the teeth slender. Achenes triangular. Stigmas 3, short.

125. **C. hystricina** Muhl. Cespitose and stoloniferous; culms 1.5 to 10 dm. high, rough above; leaf-blades 2 to 10 mm. wide; staminate spike 1 to 5 cm. long, slender-peduncled; pistillate spikes 1 to 4, approximate or strongly separate, densely many-flowered, oblong or oblong-cylindric, 1 to 6 cm. long, the lower slender-peduncled; scales green, 3-nerved, rough-awned, narrower and mostly shorter than perigynia; perigynia 5 to 7 mm. long, ascending or at length spreading.

Swampy soil, Trinity Co. (Rush Creek, Yates 423). North to Alberta, east to the Atlantic.

Ref.—Carex hystricina Muhl. in Willd. Sp. Pl. 4:282 (1805), type from Penn.

126. **C. comosa** Boott. Cespitose and not stoloniferous; culms 5 to 15 dm. high, strongly roughened to smooth; leaf-blades 6 to 16 mm. wide; staminate spike 3 to 7 cm. long, slender-peduncled; pistillate spikes 1 to 4, densely many-flowered, oblong-cylindric, 1 to 7.5 cm. long, the upper erect and short-peduncled, the lower slender-peduncled and at length nodding; scales narrow, mostly shorter than perigynia, very rough-awned; perigynia lanceolate, rigid, 5 to 7 mm. long, reflexed when mature.

Swamps near the coast: San Bernardino Valley; Santa Cruz Mts. to Lake Co. North to Washington, east to the Atlantic.

Locs.—Santa Cruz Mts., *Bolander* 69; San Francisco, *Bolander* 2301 (in part); Guerneville, *Davy;* Blue Lakes, *Jepson* 26a, 26b.

Refs.—Carex comosa Boott, Trans. Linn. Soc. 20:117 (1846), Ga. and Car., *Elliott;* Mackenzie, Erythea 8:91, fig. 51 (1922). *C. furcata* Ell. Sketch Bot. S. Car. and Ga. 2:552 (1824), S. Car. and Ga., not C. furcata Lapeyr. (1813). *C. pseudo-cyperus* L. var. *comosa* Boott, Ill. Car. 4:141 (1867).

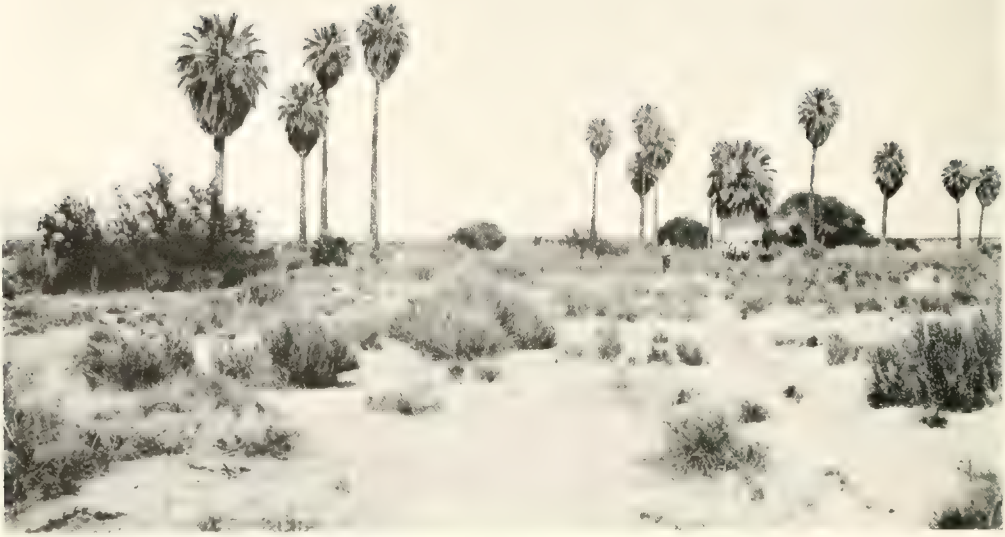

Fig. 37*a*. Washingtonia filifera Wendl. at the springs called Twenty-nine Palms, on the north border of the Colorado Desert 40 miles north of Mecca. There were 16 palms living in 1914, the tallest one being 70 feet high with a trunk 2¾ feet in diameter. (Jepson, photo.)

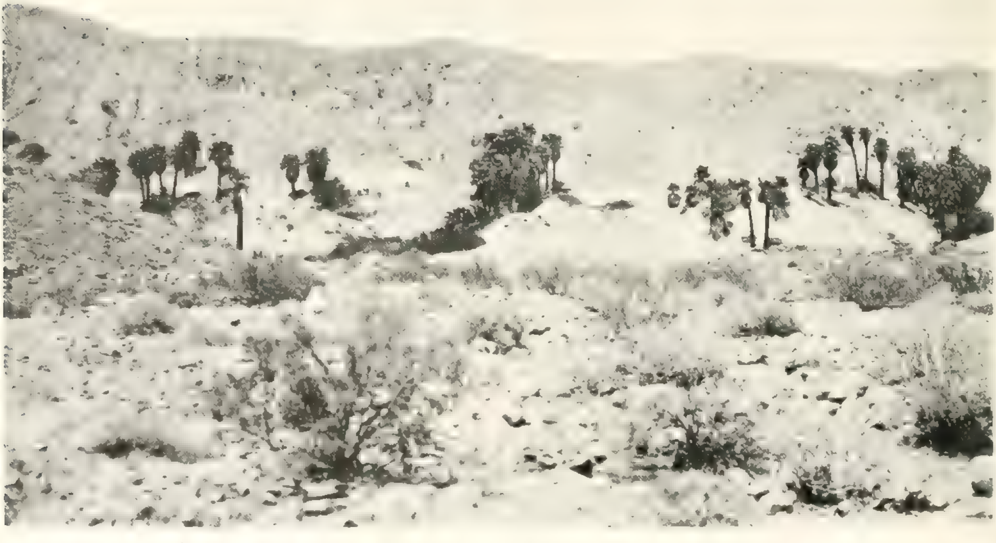

Fig. 37*b*. Washingtonia filifera Wendl. in the cañon called Hidden Palms about 18 miles northerly from Indio. (Jepson, photo.)

PALMACEAE. Palm Family.

Commonly trees with fibrous roots and columnar unbranched trunks covered with leaf-scars or the bases of leaf-stalks and bearing a tuft of large leaves at summit. Leaves sharply plaited when young, eventually tearing more or less along the lines of the folds. Flowers minute, commonly monoecious, in ours perfect, borne in a large inflorescence enclosed by a spathe. Perianth in two circles, an outer 3-lobed calyx and an inner 3-parted corolla. Stamens 6, inserted on the corolla-tube. Carpels 3, separate or united, each 1-ovuled. Fruit a berry, drupe or nut.—Genera 128 and species about 1200, almost entirely in the tropics.

1. WASHINGTONIA Wendl. Fan Palm.

Trees with fan-shaped much folded blades and long petioles armed with stout hooked spines along the margins. Pistil 1; ovary 3-celled; style and stigma 1. Fruit a berry.—Species 3, Southern and Lower California and Sonora.

Bibliog.—Parish, S. B., California Palms (Gard. & For. 3:51–52,—1890); Contribution towards a knowledge of the genus Washingtonia (Bot. Gaz. 44:408–434, figs. 1–12,—1907); Roezl and the type of Washingtonia (Bot. Gaz. 48:462–463,—1909).

1. **W. filifera** Wendl. California Fan Palm. (Fig. 37.) Columnar tree 20 to 75 feet high, the trunk 1 to 3 feet in diameter at the enlarged base, covered with a scaly rind and sometimes clothed quite to the ground with a thatch of dead persistent recurved leaf-bases; leaves fan-shaped, 3 to 6 feet long, with 40 to 60 folds, torn nearly to the middle, the divisions copiously fibrous; petioles 2 to 5 feet long, very stout; flowers borne in a branched panicle on long stems, the whole 8 to 12 feet long; berries borne on pedicels 1 to 1½ lines long, black, oval, 3 to 3½ lines long, with thin flesh surrounding a large seed which is flattened somewhat on the ventral side; endosperm horny.

Westerly and northerly sides of the Colorado Desert, on or above the old beach line of the one-time interior sea, always in moist spots or oases, from near sea-level to 3500 ft.

Locs.—West side of Colorado Desert (south to north): Palm Sprs., 9 mi. e. of Vallecito Sprs. (palms now destroyed, U. S. Geol. Sur. Water-Supply Paper 224:85); Mountain Palm Sprs., a few miles southerly from the preceding sta.; several trees in Hell-hole Cañon, Mt. San Ysidro; Palm Cañon of San Ysidro, the lowest group in the cañon (½ mi. from mouth of gorge) has about 86 large trees and 45 small ones (Dutton & Jepson), the entire cañon said to contain a thousand; Indian Cañon, opening n. into Collins Valley, trees in all the western side-cañons where there is water and also at intervals in upper part of main cañon (Dutton & Jepson); Thousand Palms Cañon, opening into Collins Valley (the number of trees does not justify the name—Wm. Schnoka); Las Coyotas, Coyote Cañon; Seventeen Palms, at southeasterly base of the Santa Rosa Mts. in the Sheep Hills; Dos Palmas, easterly from Piñon Flat, Santa Rosa Mts., 3500 ft. alt.; Palm Cañon of San Jacinto, about 100 trees; Lukens Cañon, 50 or 60 trees; Murray Cañon, about 100 trees; Andreas Cañon, about 35 trees; side cañon of Snow Creek, n. slope Mt. San Jacinto, about 12 trees; 7 mi. further west, cañon with 2 trees, the trees now destroyed (Jepson, Silva Cal. 172).

North side of Colorado Desert (west to east): Whitewater Cañon; Seven Palms (easterly from Palm Sprs. sta.); Willis Palms (F. H. Willis ranch, 4 mi. northeasterly from Edom sta.); Thousand Palms, a very fine assemblage in Thousand Palms Cañon, 4½ mi. northeast of Edom sta.; Hidden Palms, 2 groups in a cañon 1 mi. e. of preceding locality); Pushwalla Palms in Pushwalla Cañon, next east; thence eastward a number of groups along the base of the mountains north of Indio, including the Twelve Apostles group; northerly from Mecca and about 6 mi. southerly from Shaver Well are two small palm groups in cañons; cluster on the alkaline flats near Mecca (Carnegie Publ. 193: 106); Dos Palmas (two palms at a spring 6 mi. e. of Salton sta.); said to occur also in Red Cañon, Chuckawalla Mts. (Parish, Pl. World 17:123), which would be the most easterly locality; Twenty-nine Palms, 40 mi. n. of Mecca, the most northerly locality; 4 mi. e. of Cottonwood Sprs., Cottonwood Mts., about 100 trees in a cañon acc. E. C. Jaeger.

Refs.—Washingtonia filifera Wendl. Bot. Zeit. 37:68 (1879); Jepson, Silva Cal. 172, pls. 6, 55 (1910). Var. *robusta* Parish, Bot. Gaz. 44:420 (1907). *W. robusta* Wendl. Gart. Zeit. 2:198 (1883). Var. *microsperma* Becc. in Parish, l.c. *W. filamentosa* Ktze. Rev. Gen. Pl. 2:737 (1891); Sargent, Silva N. Am. 10:47, pl. 509 (1891). *Neowashingtonia filamentosa* Sudw. U. S. D. A. Div. For. Bull. 14:105 (1891).

ARACEAE. Arum Family.

Perennial glabrous herbs with large leaves, perfect or usually unisexual flowers crowded on a spadix surrounded by a usually colored spathe. Ovary 1 to several-celled, ovules 1 to several in each cell.—Genera 105 and species 900, mostly tropical, a few in the temperate zones.

Bibliog.—Engler, A., Araceae (DC. Monog. Phan. 2:1–681,—1879).

1. LYSICHITON Schott.

Peduncle and basal leaves from a stout rootstock. Flowers perfect, the calyx 4-lobed with 4 stamens opposite the segments. Ovary 2-celled, 1 ovule in each cell; stigma depressed. Fruit a 2-seeded berry sunk in the spadix.—Species 1. (Greek lusis, loose, and chiton, a tunic or covering, referring to the spathe.)

1. **L. kamtschatcensis** Schott. Skunk Cabbage. Coarse herb; leaves yellow, oblong to elliptic, 1 to 1½ feet long and ½ to ¾ feet wide; peduncle stout, shorter than the leaves; flowering spadix about 1 inch long.

Swamps along the coast: Santa Cruz Mts. to Humboldt Co.; north to Alaska and Siberia.

Locs. Felton, *M. L. Hutchinson;* Ben Lomond, *Geo. J. Streator;* Russian River (Fl. W. Mid. Cal. ed. 2, 87); Ft. Bragg (Bot. Cal. 2:187); Eureka, *Jepson*; Little Van Duzen bridge, acc. *Tracy.* Juneau, Alas., *Jepson* 479.

Refs.—Lysichiton kamtschatcensis Schott, Prod. Aroid. 421 (1860). *Dracontium kamtschatcense* L. Sp. Pl. 2:968 (1753), type loc. Siberia.

LEMNACEAE. Duckweed Family.

Minute floating or submerged aquatic perennials, without leaves. Plant body consisting of a leaf-like stem or "frond" which is densely green, disk-shaped, elongated or irregular. Basal margin of the frond with 1 or 2 clefts or reproductive pouches. Vegetative reproduction active, the daughter fronds arising from the reproductive pouches and attached to the parent frond by slender stalks (or stipes). Inflorescence, when present, consisting of a simple cluster of 2 staminate flowers and 1 pistillate flower, contained in the reproductive pouch, subtended by a sac-like spathe, and imitating a single flower. Staminate flower consisting of a single stamen and the pistillate flower of a single ovary with 1 to 7 ovules. Perianth none. Flowers and fruit scarce, in one genus unknown. The daughter fronds soon separate or remain connected for some time; they may at certain seasons sink to the bottom of the pond or ditch and undergo a resting period.—Genera 4, species about 25, temperate and tropical zones.

Bibliog. Hegelmaier, Friedr., Systematische Uebersicht der Lemnaceen (Engl. Bot. Jahrb. 21:268–305,—1895). Thompson, C. H., Revision of Am. Lemnaceae (Rep. Mo. Bot. Gard. 9:21–42, pls. 1–4,—1897). McAtee, W. L., Duckweeds [as wild duck foods] (U. S. D. A. Bull. 205:3–5,—1915).

Fronds with roots; vegetative pouches 2, posteriorly placed.
  Frond 5 to 15-nerved, with several roots........1. Spirodela.
  Frond 1 to 5-nerved, with a single root........2. Lemna.
Fronds without roots, thin, strap-shaped; vegetative pouches 1........3. Wolffiella.

1. SPIRODELA Schleiden.

Fronds with many fascicled roots. Roots with one vascular bundle. Reproductive pouches 2, with cleft-like openings in either margin of the basal portion of the frond. Inflorescence consisting of a cluster of 1 pistillate and 2 staminate flowers borne in the reproductive pouches and subtended by a sac-like spathe. Fruit round-lenticular, with winged margins.—Species about 6, all continents. (Greek speira, a cord, and delos, evident.)

1. **S. polyrhiza** Schleiden. Fronds solitary or in colonies of 2 to 5, roundish obovate, 5 to 15-nerved, 1½ to 4 lines long, usually sterile.

Southern California. Cosmopolitan.

Locs.—San Bernardino (Engl., Bot. Jahrb. 21:284); Pitt River (e. of Hat Creek), *Brewer* 2190.

Refs.—SPIRODELA POLYRHIZA Schleiden, Linnaea 13:392 (1839). *Lemna polyrhiza* L. Sp. Pl. 970 (1753), type European.

2. LEMNA L. DUCKWEED.

Fronds disk-shaped, usually with a central nerve and with or without several lateral nerves, each with a single root which is commonly provided with a root cap. Reproductive pouches 2, appearing as clefts in either margin of the basal portion of the frond, each containing a cluster of 3 flowers surrounded by a spathe. Ovary with 1 to 7 ovules. Fruit ribbed.—Species about 8, all continents. (Ancient Greek name.)

Frond with a long stipe, mostly submerged and forming large masses; papillae none........3. *L. trisulca.*

Frond with a short stipe, floating on the surface.
Symmetrical or nearly so, papillate along the median line.
Oblong-ovate; fruit more or less lenticular.
Upper surface uniformly green; margin of the fruit without appendages; seed always 1........2. *L. minor.*
Upper surface mottled with irregular brown streaks; margin of the fruit with rounded wing lobes; seeds 1 to several........1. *L. gibba.*
Oblong to elliptical, small, green on both surfaces, with a row of papillae along the mid-nerve; fruit elongated........5. *L. minima.*
Unsymmetrical.
Obliquely obovate, obscurely 3 to 7-nerved, papillate along the median line....1. *L. gibba.*
Long oblong, thin, obscurely 1-nerved; papillae none........4. *L. cyclostasa.*

1. **L. gibba** L. GIBBOUS DUCKWEED. Fronds 1 to 4 in a group, commonly 2, orbicular to obovate, slightly to very unsymmetrical, usually 3 to 5-nerved, 1 to 2 lines wide, 1 to 2½ lines long, thick, convex and slightly keeled above, flat to strongly gibbous beneath; base usually acute and commonly with narrow wing margins; pistil clavate; ovules 1 to 7; fruit symmetrical, purple-tinted, winged with rounded lobes at the upper margin on either side of the stigma.

Stagnant ponds. All continents except South America.

Locs.—Pasadena, Compton, Santa Monica Cañon, San Pedro, San Juan Capistrano (Erythea 4:195); Mound City, San Bernardino Valley (Erythea, 7:90); San Francisco (Bot. Cal. 2:190).

Ref.—LEMNA GIBBA L. Sp. Pl. 970 (1753), type European.

2. **L. minor** L. SMALLER DUCKWEED. Fronds solitary or few in a cluster, round to elliptic-obovate, green or purplish beneath, uniformly bright-green above, convex on both sides, upper surface sometimes slightly keeled and with a row of papillae along the mid-nerve, the apical one usually quite prominent; pistil clavate; ovule 1; fruit not winged, projecting about ⅓ beyond the margin of the frond.

Stagnant pools, abundant. All continents except South America.

Loc.—Lobos Creek, San Francisco (Bot. Cal. 2:190).

Ref.—LEMNA MINOR L. Sp. Pl. 970 (1753), type European.

3. **L. trisulca** L. IVY-LEAF DUCKWEED. Fronds forming dense masses, oblong to oblong-lanceolate, slightly unsymmetrical and frequently a little falcate, 2½ to 5 lines long and 1½ lines wide, the long stipe attached to the basal margin; floating fronds with shorter stipes and cavernous throughout the central portion; submerged fronds with long twisted stipes; seed prominently 12 to 15-ribbed.

Cold springs and running water, Sierra Nevada. All continents except South America.

Locs.—Plumas Co. (Bot. Cal. 2:189); Bouldin Isl. (Zoe, 4:217); San Francisco (Bot. Cal. 2:189); San Gabriel Creek, San Gabriel Mts. (Bot. Cal. 2:189).

Ref.—LEMNA TRISULCA L. Sp. Pl. 970 (1753), type European.

4. **L. cyclostasa** Chev. Fronds solitary or more commonly 2 to 8 cohering in a more or less curved chain, thin, oblong to obovate-oblong, usually somewhat falcate, ⅓ to ¾ lines wide by 1 to 1¼ lines long, without papillae; base of the

frond usually unsymmetrical, tapering into a short stipe or frequently sessile; fruit long-ovate, pointed by the long, straight or rarely curved style; seed 12 to 29-ribbed.

Springs and pools. North and South America.

Locs.—Springs at foot of Uncle Sam Mt. (Mt. Konokti , Lake Co., *Bolander* 2662; Santa Cruz (Engler, Jahrb. 21:298).

Refs.—Lemna cyclostasa Chev. Fl. Par. 2:256 (1827). *L. minor* var. *cyclostasa* Ell. Bot. S. Car. and Ga. 2:518 (1824). *L. valdiviana* Phil. Linnaea 33:239 (1864).

5. **L. minima** Phil. Fronds cohering in 2s, sometimes in 4s, or solitary, oblong to elliptical, symmetrical, ½ to 1¼ lines wide, ¾ to 2 lines long, rather thick, with a row of papillae along the mid-nerve; lower surface flat or slightly convex, upper surface slightly to prominently convex with thin margin entirely around the frond; frond cavernous in the middle portion only, commonly nerveless; seed oblong, pointed, about 16-ribbed.—Two growth stages: smaller fronds straw-yellow or pale green and strikingly convex on the upper surface; larger fronds thinner and green-colored.

Pools, California, east to Wyoming and Florida.

Locs.—San Bernardino (Erythea, 7:90); San Francisco (Engl., Jahrb. 21:299).

Ref.—Lemna minima Phil. Linnaea, 33:239 (1864), type from Chile.

3. WOLFFIELLA Hglm.

Fronds minute, thin, band-like or ligulate, somewhat curved, rootless. Reproductive pouch one, triangular, opening as a cleft in the basal margin of the frond. Flowers and fruit unknown. Stipe of the daughter frond attached on the margin of the reproductive pouch.—Species about 7, mostly in the tropics. (Diminutive of Wolffia.)

Fronds saber-shaped........1. *W. oblonga.*
Fronds ligulate........2. *W. lingulata.*

1. **W. oblonga** Hglm. Fronds solitary or in pairs, rarely 3s, slightly falcate, tapering from the rounded base to the somewhat narrower rounded apex, sometimes oblong, rarely straight, 1½ to 2¼ lines long.

Southern California. Mexico, South America.

Loc.—San Bernardino Valley (acc. Thompson, Rep. Mo. Bot. Gard. 9:39).

Refs.—Wolffiella oblonga Hglm. Engler, Bot. Jahrb. 21:303 (1895). *Lemna oblonga* Phillipi, Linnaea, 29:45 (1857), type loc. Santiago, Chile, *Philippi.*

2. **W. lingulata** Hglm. Fronds solitary or in pairs, ovate to oblong-ligulate, 1¼ to 3¼ lines long.

Kern Co.; San Bernardino Valley. Mexico.

Locs.—Kern Co. (acc. Thompson, Rep. Mo. Bot. Gard.—1897); San Bernardino Valley (Erythea 7:90).

Refs. Wolffiella lingulata Hglm. Engler, Bot. Jahrb. 21:303 (1895). *Wolffia lingulata* Hglm. Monog. Lemnae, 132 (1868).

PONTEDERIACEAE. Pickerel Weed Family

Aquatic herbs. Perianth with a tube, 6-lobed or 6-parted. Stamens 3 or 6, inserted on the throat of the perianth. Ovary superior, 1 or 3-celled.—Genera 5 and species about 24, all continents except Europe, mostly in the tropics and warm temperate regions.

Bibliog.—Solms-Laubach, Pontederiaceae (DC. Monog. Phan. 4:501–535,—1883).

1. HETERANTHERA R. & P.

Ours submerged grass-like herbs, only the flowers reaching the surface. Spathe 1-flowered. Perianth with elongated filiform tube and rotate 6-parted limb; segments linear-lanceolate. Stamens 3. Ovary 1-celled with 3 parietal placentae.—Species 9, North and South America, Africa. (Greek heteros, different, and anthera, anther, the stamens unequal in some species.)

1. **H. dubia** MacM. Leaves linear or ribbon-like, translucent; perianth small, pale yellow, its tube about 4 inches long.

Still water: Mendocino Co. acc. Bot. Cal. 2:187 (1880). Oregon and east to the Atlantic.

Refs.—HETERANTHERA DUBIA MacM. Met. Minn. 138 (1892). *Commelina dubia* Jacq. Obs. Bot. 3:9, pl. 59 (1768), type coll. by *Clayton*, undoubtedly in Virginia. *Schollera graminea* Gray, Man. 511 (1848).

Eichornia Kunth. Herbs with rootstock floating or rooting in mud. Petioles wholly or partly inflated, the blades roundish to ovate. Perianth bluish purple. Stamens 6. Ovary 3-celled. E. CRASSIPES Solms. Water Hyacinth. Scapes 4 to 16 in. high; blades 2½ to 3 in. broad.—Introduced from tropical America and locally established as a weed at a few stations.

Locs.—Warm Creek reservoir, San Bernardino, beginning to extend down stream, *Parish* 11648; sloughs and ponds east of Fresno in the foothills acc. *Eugene Heath;* Clarksburg, Yolo Co., *Eleanor W. Smith*. In tropical waters and in Florida the plants multiply vegetatively with rapidity and become a menace, since often obstructing navigation in rivers and rendering lakes and streams unsightly.

Refs.—EICHORNIA CRASSIPES Solms in DC. Monog. Phan. 4:527 (1883). *Pontederia crassipes* Mart. Nov. Gen. 1:9, t. 4 (1824), type loc. Brazil. *Piaropus crassipes* Britt. Ann. N. Y. Acad. 7:241 (1893).

JUNCACEAE. RUSH FAMILY

Annual or perennial herbs. Stems simple, terete or ancipital. Leaves alternate, sheathing, narrow, flat or terete. Flowers lily-like in structure, sedge-like in aspect, small, dry, perfect, disposed in terminal or sometimes apparently lateral heads, spikes, corymbs or panicles. Perianth with 6 distinct similar glume-like segments. Stamens 6 or sometimes 3. Ovary superior, 3 or sometimes 1-celled; stigmas 3, filiform; ovules 3 to many. Fruit a loculicidally 3-valved capsule. Embryo minute, enclosed in fleshy endosperm.—In both the genera Luzula and Juncus, individuals of the same species vary greatly in aspect owing to the tendency of the inflorescence to become either capitately-congested on the one hand or loosely paniculate on the other. The hue of the inflorescence is, however, very constant. The lowest bract of the inflorescence is here termed the involucral bract.—Genera 8, the species about 300, widely dispersed.

Bibliog.—Engelman, Geo., Revision of N. Am. Species of the genus Juncus (Trans. St. Louis Acad. 2:424–498,—1866–1868). Buchenau, F., Monog. Juncacearum (Engler, Jahrb. 1:104–141,—1880); Die Verbreitung der Juncaceen uber die Erde (l.c. 12:1–145,—1890); Juncaceae (Engler, Pflzr. 4^{36}:1–284, figs. 1–121,—1905). Wiegand, K. M., Juncus tenuis and some of its N. Am. allies (Bull. Torr. Club, 27:511–527,—1900). Parish, S. B., Southern Cal. Juncaceae (Muhl. 6:113–120, 121–128,—1910). Fernald & Wiegand, N. Am. Variations of Juncus effusus (Rhod. 12:81–93,—1910).

Leaves stiff, terete or flat; stems usually with spongy pith; capsule 3 or 1-celled; seeds several to many..........1. JUNCUS.
Leaves soft, flat; stems hollow; capsule 1-celled; seeds 1 to 3..........2. LUZULA.

1. JUNCUS L. RUSH

Plants of swamps or wet places; herbage glabrous. Stems simple (rarely branching), with spongy pith or sometimes hollow, leafy, or naked and scape-like. Leaves stiff, terete, channeled or flat, the blades arising from sheaths or the sheaths sometimes bladeless. Flowers greenish or brownish. Stamens 6, or when 3 opposite the outer perianth segments. Capsule 3-celled with central placentae or 1-celled with 3 parietal placentae, many-seeded. Species 207, all continents. (Classical name for the Rush, perhaps from Latin jungo, to join, the stems used for binding.) Sheaths sometimes bearing a ligule at summit.

A. Inflorescence apparently lateral; involucral bract erect, appearing like a continuous prolongation of the stem; leaves all basal, reduced to sheaths or the inner sheaths sometimes blade-bearing and terete; ligules none; stems scape-like; perennials.

Flowers 3 to 9 in head-like clusters, the clusters disposed in a panicle; inner sheaths blade-bearing; stems and blades stout and pungent.
  Perianth segments brownish, scariously margined or winged, the inner obovate, emarginate, a line long; capsule subglobose, obtuse..........1. *J. acutus.*
  Perianth segments greenish, not winged, the inner lanceolate, rarely ovate, acute, 3 lines long; capsule ovate, acute..........2. *J. cooperi.*

Flowers inserted singly on the racemose branches of the panicle, distinctly separated to somewhat crowded but never truly capitate; stems usually slender and rigid; sheaths bladeless except nos. 6 and 10.

Flowers many to numerous, in panicles or compound panicles.

Flowers large (2 lines long or more); perianth segments scarious-margined; capsule oblong-ovate.

Flowers dark brown; perianth segments with deep purple margins.........3. *J. leseurii.*

Flowers mostly greenish; perianth segments with whitish margins or only faintly purplish.

Sheaths quite bladeless.

Perianth greenish or dark, the bractlets scarious; common, widely distributed. 4. *J. balticus.*

Perianth and bractlets concolorous; S. Cal.........5. *J. textilis.*

Sheaths bearing scape-like blades.........6. *J. mexicanus.*

Flowers small (less than 1 line long); perianth segments not scarious-margined; capsule obovate or subglobose.

Stamens 6; capsule broadly subglobose, obtuse, apiculate.........7. *J. patens.*

Stamens 3; capsule narrow, clavate, obovate, obtuse or retuse.........8. *J. effusus.*

Flowers few (1 to 3); low alpine plants.

Inner sheaths bristle-tipped; capsule retuse; plants ½ to 1½ feet high..9. *J. drummondii.*

Inner sheaths blade bearing; capsule acute; plants ½ foot high or less......10. *J. parryi.*

B. Inflorescence terminal; involucral bract not a continuation of the stem (or if so conspicuously channeled along the upper side).

1. LOW DWARF ANNUALS WITH FIBROUS ROOTS.

Stamens 6; flowers secund, remote; stems branching from the base; leaves cauline.

Plants 4 to 10 inches high; capsule oblong.........11. *J. bufonius.*

Plants 1½ to 2 inches high; capsule elliptic.........12. *J. sphaerocarpus.*

Stamens 3; flowers in small heads; stems short with several scape like peduncles; leaves mostly basal; plants 1 to 3 inches high; capsule ovate, apiculate.........13. *J. triformis.*

2. TALLER PERENNIALS; ROOTSTOCKS MOSTLY STOUT AND CREEPING.

a. Leaves not transversely ribbed, usually flat.

Stems naked; flowers solitary in a diffuse (rarely compact) panicle; leaves very fine, with ligules.........14. *J. tenuis.*

Stems more or less leafy; flowers capitate or clustered; leaves flat or grass-like.

Stems low, mostly equaling the leaves; ligules none; styles usually short.

Involucral bract short; heads usually solitary; perianth equaling the capsule; segments brown margined.........15. *J. falcatus.*

Involucral bract elongated; heads 3 to 6; perianth shorter than the capsule; segments broadly white margined.........16. *J. obtusatus.*

Stems taller, exceeding the leaves; heads 2 to 6 or many; styles long exserted.

Ligules present; leaves narrow.

Anthers red-brown; leaves channeled.........17. *J. canaliculatus.*

Anthers white; leaves flat.........18. *J. longistylis.*

Ligules absent; leaves broad.........19. *J. latifolius.*

b. Leaves transversely ribbed by internal septa.

Leaves narrow, terete or sub-terete, not equitant; ligules and septations conspicuous; stems usually slender.

Early leaves capillary and floating.........20. *J. supiniformis.*

Leaves all erect, not capillary or floating.

Heads large (except. no. 22).

Perianth dark colored.

Heads usually few or solitary; perianth segments moderately pliable.

Very slender mostly low grass-like plants; heads very dark.

Heads solitary, wholly very dark brown; capsule obovate, obtuse; styles included; high montane.........21. *J. mertensianus.*

Heads usually two or more, dark brown with whitish or scarious bractlets at base; capsule oblong, acutish; styles exserted.........22. *J. nevadensis.*

Tall plants with less slender stems; heads densely many-flowered; perianth dark brown; capsule very dark; coast valleys.........23. *J. bolanderi.*

Heads numerous in a dense or capitate cluster; perianth segments lanceolate, light brown, subspinescent or very rigid.........24. *J. torreyi.*

Perianth segments pale and scarious, often obtuse.........25. *J. chlorocephalus.*

Heads small, numerous, in large compound panicles; plants very tall and slender.

Stems slender, smooth.........26. *J. dubius.*

Stems stouter, markedly rugulose.........27. *J. rugulosus.*

Leaves equitant, usually flattened; septations inconspicuous; ligules usually inconspicuous or absent; stems rather stout, ancipital.

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Heads small, numerous, in large compound panicles; perianth segments linear-lanceolate; capsule narrow, attenuate.......28. *J. oxymeris.*
Heads larger, usually few; perianth segments lanceolate; capsule oblong, acute.
  Leaves 2 to 4 lines wide; perianth segments light reddish brown; capsule abruptly acuminate, shorter than the perianth.
    Stamens 6; valleys and lower altitudes.......29. *J. xiphioides.*
    Stamens 3; higher mountains or near the coast northward.......30. *J. ensifolius.*
  Leaves ½ to 1½ (or 2) lines wide; perianth segments very dark; capsule long acuminate, equaling the perianth.......31. *J. phaeocephalus.*

1. **J. acutus** L. var. **sphaerocarpus** Engelm. (Fig. 38a, b.) Stems terete or slightly compressed, 2 to 4 feet high, stout, rigid and pungent; panicle compound with unequal branches, usually 3 to 6 inches long, erect and strict, usually exceeding the involucral bract; secondary bracts long acuminate, equaling or exceeding the flowers; clusters 2 to 4-flowered; perianth segments scarious-margined very broadly at apex, especially the inner, 1 line long, exceeding the stamens, the outer broadly lanceolate, acute, the inner obovate and deeply emarginate; capsule subglobose, narrower at base, rounded at summit, apiculate, brown, nearly 2 lines long; seeds acute at each end or slightly caudate, about ½ line long, very finely ribbed.

Along the coast from San Francisco to San Diego, thence east into the Colorado Desert and south into Lower California.

Locs.—Jamul Valley, San Diego Co., *Palmer* 380; Coahuilla Valley region, *D. P. Barrows*; Santa Catalina Isl., *T. Brandegee*; Oceanside, *Parish* 4400; Oxnard, *Davy* 7836; Indio, *Davy* 7935; w. edge Colorado Desert, *Parish* 6149. Forma *xanthosus* Jepson n. forma, capsule less rounded, yellow.—Thousand Palms Cañon, nw. of Indio, *Jepson* 6041 (type); Chuckawalla Sprs., *Hall* 5978.

Refs.—JUNCUS ACUTUS L. var. SPHAEROCARPUS Engelm. Bot. Wheeler, 376 (1876), type loc. Santa Barbara, *Rothrock*. *J. robustus* Wats. Proc. Am. Acad. 14:302 (1879).

2. **J. cooperi** Engelm. (Fig. 38c.) Similar in habit to J. acutus but the flowers larger, the perianth segments lanceolate, the outer acute, the inner mucronate, 2½ to 3 lines long; capsule ovate, acute, slightly longer than the perianth, greenish; seeds larger, with broad white appendages at each end, or slightly margined on one side.

Salt marshes and alkaline flats, Colorado and Mohave deserts. East to Nevada.

Locs.—Salt Creek, Death Valley, *Grinnell*; Death Valley, *Jepson* 6943 (Eagle Borax Works), 6881 (Texas Spr.); Saratoga Sprs., Death Valley, *Parish* 10025; Panamint Lake, Inyo Co., *Parish* 10154; Soda Lake, e. Mohave Desert, *Parish* 9874; travertine terraces, Salton Sea, *Parish* 8428; Dos Palmas, Colorado Desert, *Parish* 8382; Carrizo Creek, *T. Brandegee*.

Refs.—JUNCUS COOPERI Engelm. Trans. Acad. St. Louis 2:590 (1868), type loc. region of Camp Cady, e. Mohave Desert, *Cooper*; Coville, Bull. Torr. Club 19:309 (1892); Buch. in Engler, Pflzr. 4^{36}:152, fig. 77 (1906).

3. **J. leseurii** Boland. SALT RUSH. (Fig. 38d, e.) Stems 1 to 3 feet high, stout, erect, terete; rootstock stoutish; panicle lateral, lax or compact, many-flowered; flowers commonly somewhat secund; perianth segments with green midribs and membranous mostly purplish brown margins, 2 to 3 lines long, outer segments lanceolate-acuminate, the inner ones a little shorter and sometimes less pointed; capsule oblong or ovoid, mucronate, triangular, shorter than the perianth; seeds ovoid, obtuse, scarcely apiculate, smoothish or faintly reticulate, ⅓ to ½ line long.

Salt-marshes or near sand dunes or beaches, Monterey Co. to Humboldt Co. North to Alaska.

Locs.—Eureka, *Tracy* 1190½; Lake Pilarcitos, San Mateo Co., *Davy* 758; Point Lobos, San Francisco, *Davy* 4010; Monterey, *Ferguson* 277. Var. **tracyi** Jepson n. var. Inflorescence densely capitate.—Sand dunes, Eureka, *Tracy* (type).

Refs.—JUNCUS LESEURII Bol. Proc. Cal. Acad. 2:179 (1863), type loc. San Francisco Bay region, *Bolander*; Buch. in Engler, Pflzr. 4^{36}:147, fig. 75 (1906). *J. balticus* Willd. subsp. *pacificus* Engelm. Trans. St. Louis Acad. 2:448 (1866), 490 (1868). *J. breweri* Engelm. Trans. St. Louis Acad. 2:440 (1866), type loc. Monterey, *Brewer* 651, is merely a very slender form. Var. TRACYI Jepson.

4. **J. balticus** Willd. WIRE RUSH. (Fig. 38f, g.) Plants caespitose, grass-like, 1 to 3½ feet high; stems strict, terete or sometimes compressed, mediumly stout, sulcately channeled; panicle lateral, lax, many-flowered, its branches disposed to be secund; perianth segments lanceolate, acuminate, greenish, 1½ to 2½ lines long, sometimes faintly lined with purple inside the white scarious margins; inner segments a little shorter and less pointed or obtuse; capsule equaling or shorter than the perianth, ovoid, acute; seeds shortly oblong-cylindric, obscurely apiculate and faintly striate longitudinally, ¼ to ⅓ line long.

Widely spread throughout California. America, Europe.

Locs.—Gazelle, Shasta Valley, *Goldsmith* 16; Calistoga, *Jepson* 7664; Petaluma, *Davy* 4051; Little Oak, Solano Co., *Jepson*; Montezuma Hills, Solano Co., *Jepson*; Carmel, *Ferguson* 284; Avery Sta., Calaveras Co., *A. L. Grant* 4d; Phoenix Lake, Sonora, *A. L. Grant* 58; Middle Camp, Tuolumne Co., *Jepson* 6454; Bakersfield, *Leckenby;* Tulare Co., *Davy* 2447 (stout, intergrade to *J. textilis* Buch.); Owens Lake, *Jepson* 5116; Afton, Mohave Desert, *Parish* 9852; Barstow, *Jepson* 4798; Mecca, *Parish* 8455; Lytle Creek, San Bernardino, *Parish* 8013. In desert spms. the capsules are usually longer than the perianth.

Var. **montanus** Engelm. Lower, the stems more slender, sometimes flattened; panicle very small.—Montane: Medicine Lake, Mt. Hoffman, *Goldsmith* 31, 34; Carson Pass, *Jepson* 8097; Sonora Pass, *A. L. Grant* 133; Seelys Flats, San Bernardino, *Parish* (very similar to the Goldsmith spms.).

Refs.—JUNCUS BALTICUS Willd. Berlin Mag. 3:298 (1890), type loc. shores of the Baltic Sea at Warnemünde, Germany. Var. MONTANUS Engelm. Trans. St. Louis Acad. 2:441 (1866), type loc. "western plains and mountains" of the U. S.

5. **J. textilis** Buch. INDIAN RUSH. (Fig. 38h, i.) Similar to J. balticus; stems much shorter, 3 to 6 feet high, very finely channeled; panicle with longer branches; bractlets and perianth concolorous mostly; inner perianth segments obtuse.

Southern California.

Locs.—San Fernando Mission, *Parish;* Waterman Cañon, San Bernardino, *Parish* 8012 (this is exactly the same as *Parish* 8013, same station, distributed as *J. lescurii* Bol.); Fallbrook, *Parish;* Coahuilla Valley, *D. P. Barrows*; Catalina Isl. acc. Buchenau.

Refs.—JUNCUS TEXTILIS Buch. Abh. Nat. Ver. Brem. 17:336, t. 6 (1902). *J. lescurii* Bol. var. *elatus* Wats. Bot. Cal. 2:205 (1880), based on spms. from San Gabriel Cañon (*Brewer*) and Los Angeles (*Wood*).

6. **J. mexicanus** Willd. Stems slender, grass-like, usually compressed, often contorted; basal sheaths usually bearing a scapiform blade; panicle small; outer perianth segments narrowly lanceolate; capsule ovate, long-beaked.

Death Valley region and southerly through Southern California to Mexico.

Locs.—Texas Spr., Funeral Mts., *Jepson* 6878; Bloomington, San Bernardino Co., *Parish* 4727.

Refs.—JUNCUS MEXICANUS Willd.; R. & S. Syst. Veg. 7:178 (1829). *J. balticus* var. *mexicanus* Ktze. Revis. Gen. 3^2:320 (1898). *J. compressus* H.B.K. Nov. Gen. et Sp. Pl. 1:235 (1815), not Jacq. *J. balticus* f. *mexicanus* Parish, Muhl. 6:119 (1901).—Parish discusses the specific validity of J. mexicanus Willd. and makes a strong argument against it.

7. **J. patens** Mey. COMMON RUSH. (Fig. 39a.) Stems slender, densely tufted, 1½ to 3 feet high, erect, terete; rootstock creeping; sheaths rarely awn-tipped; panicle lateral, lax, many-flowered; perianth 1 line long, pale or brownish, its segments lanceolate or broadly subulate, spreading in fruit; stamens 6; anthers ¼ line long, about ½ as long as the filaments; capsule sub-globose, slightly angled, obtuse, apiculate, a little shorter than the perianth; seeds apiculate with a minute white appendage or none.

A common species, in marshy or springy ground, coastal region from Santa Barbara Co. to Del Norte Co. North to Washington.

Locs.—Mt. Hermon, Santa Cruz Co., *Rowe*; Mill Valley, *Blasdale*; Suisun Marshes, *Jepson*; Wild Horse Cañon, Vaca Mts., *Jepson* 2455; Santa Rosa, *Heller* 5680; Kneeland Prairie, Humboldt Co., *Tracy* 3848.

Refs.—JUNCUS PATENS Mey., Synops. Luzul. 28 (1823), type loc. Monterey, *Haenke*; Buch. in Engler, Pflzr. 4^{36}:131, fig. 71 (1906).

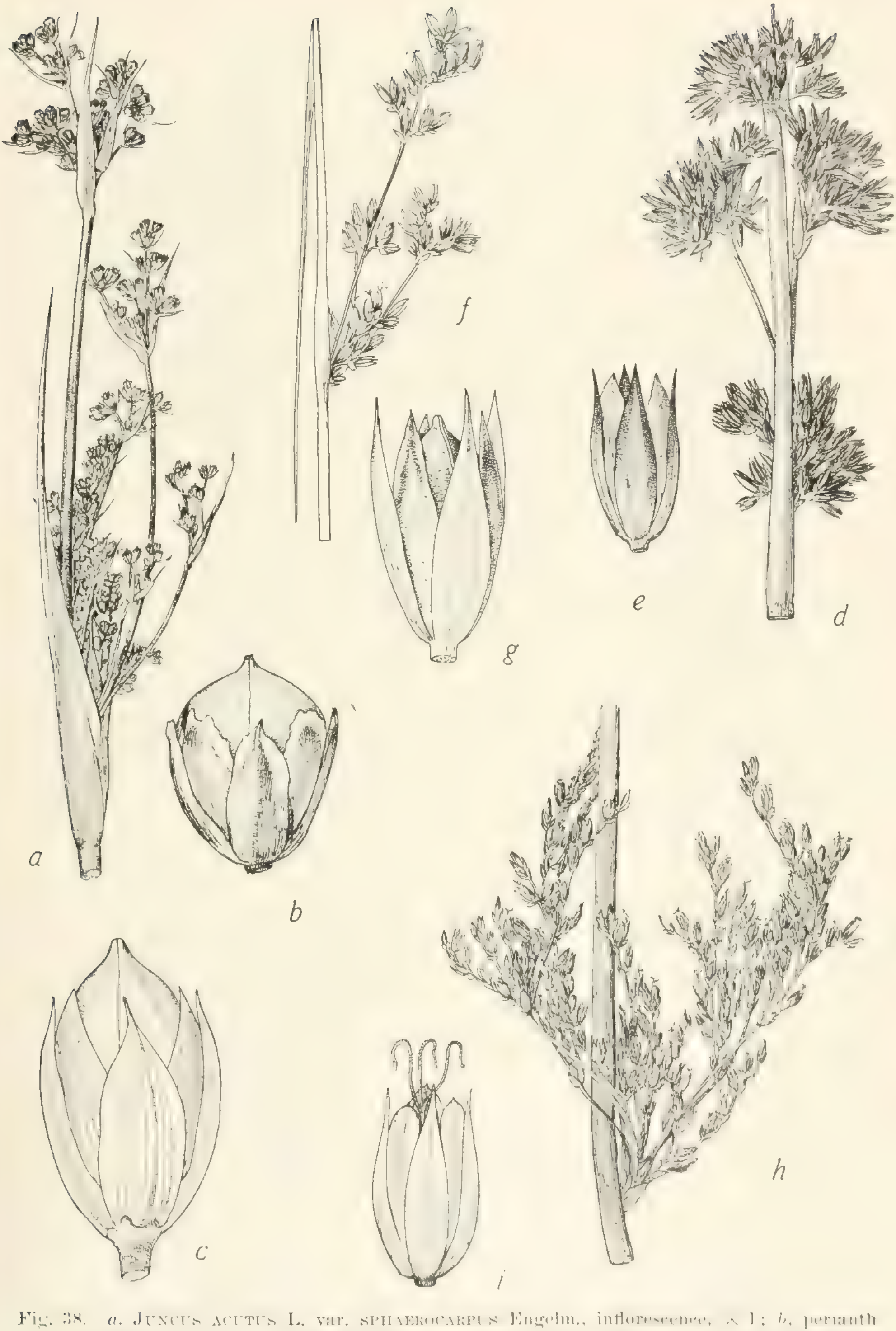

Fig. 38. *a*, JUNCUS ACUTUS L. var. SPHAEROCARPUS Engelm., inflorescence, × 1; *b*, perianth and capsule, × 9. *c*, J. COOPERI Engelm., perianth and capsule, × 6. *d*, J. LESUEURII Bolander, inflorescence, × 1; *e*, perianth and capsule, × 5. *f*, J. BALTICUS Willd., inflorescence, × 1; *g*, perianth and capsule, × 8. *h*, J. TEXTILIS Buch., inflorescence, × 1; *i*, perianth and capsule, × 7.

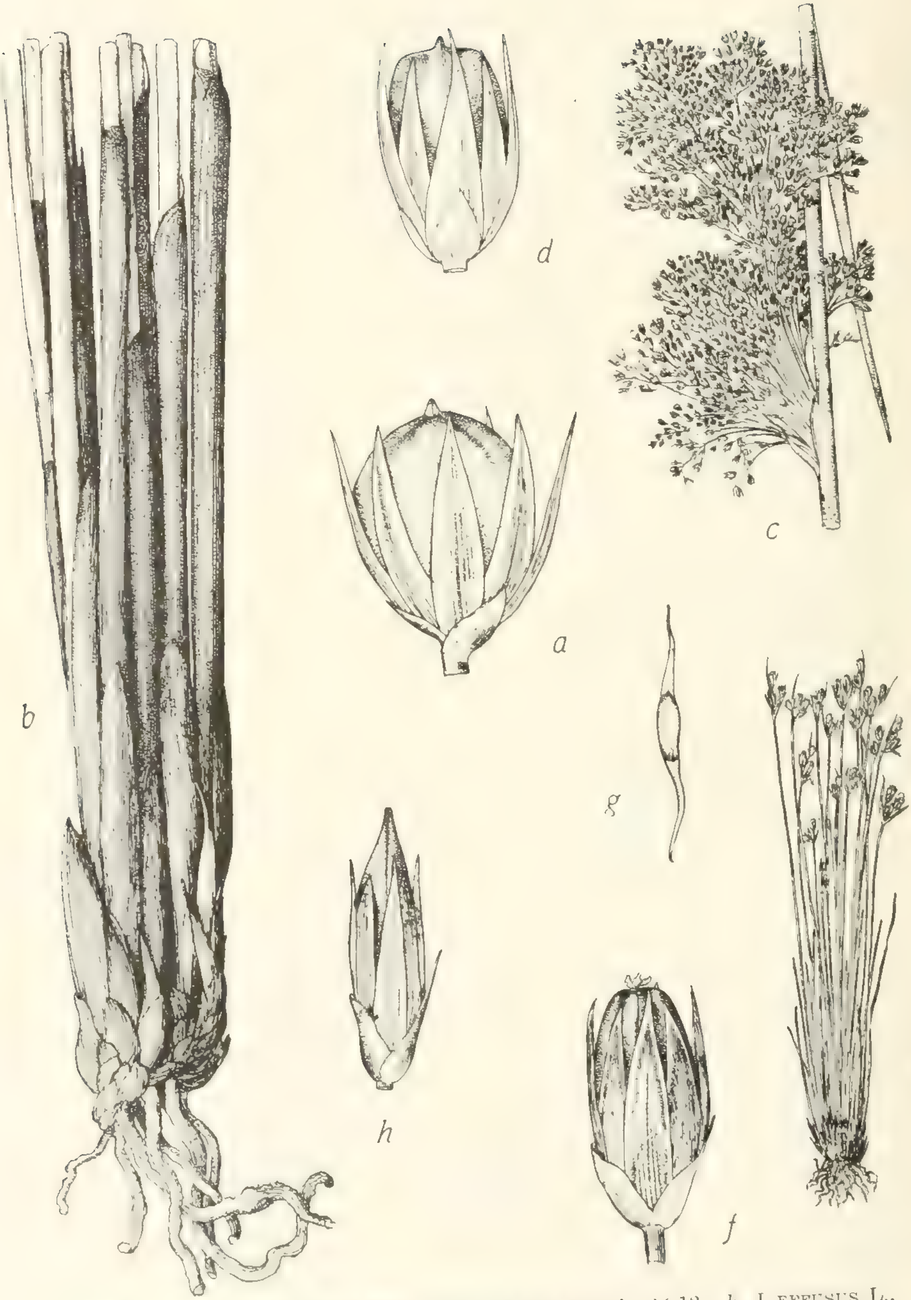

Fig. 39. *a*, JUNCUS PATENS Mey., perianth and capsule, × 12. *b*, J. EFFUSUS L., lower portion of plant, × 1; *c*, inflorescence, × 1; *d*, perianth and capsule, × 14. *e*, J. DRUMMONDII Mey., habit, × ¼; *f*, perianth and capsule, × 5; *g*, seed, × 15. *h*, J. parryi Engelm., perianth and capsule, × 5.

8. **J. effusus** L. Bog Rush. (Fig. 39b-d.) Similar in habit to J. patens but stamens and perianth segments smaller and not so spreading; stems terete, 2 to 4 feet high; inner sheaths tipped with a short awn; panicle slender, usually diffuse, many-flowered; perianth pale brown, 1 line long, the segments lanceolate, acute, equaling the capsule; capsule obovoid or even broadly clavate, obtuse or retuse, triangular; stamens 3, anthers equaling the filaments; seeds apiculate.

Common in springy spots or bogs, forming very dense or heavy clumps on hillsides or valley flats; Coast Ranges, Sierra Nevada and Southern California; also distributed widely throughout the north temperate regions of both the Old and the New World. Also called Sugar Grass.

Locs.—Santa Ana River, San Bernardino Co., *Parish*; Berkeley, *Jepson* 3072; Angwins, Howell Mt., *Jepson*; Eureka, *Tracy* 2518; La Moine, Sacramento River, *Goldsmith* 11; Sisson, *Jepson* 6156; Middle Camp near Confidence, Tuolumne Co., *Jepson* 6452; Center Camp, Tuolumne Co., *A. L. Grant* 556; Yosemite Valley, *Bolander*. The spms. cited represent the usual stoutish form of the species in California and doubtless answer to the var. pacificus Fern. & Wieg. Rhod. 12:89 (1910). The typical J. effusus L. of Europe does not occur in America acc. Fernald and Wiegand.

Var. **exiguus** Fern. & Wieg. Very slender; sheaths pale; flowers very small, pale.—Yosemite Park; Widow Creek, Mt. Shasta, *Goldsmith* 36. Var. **gracilis** Hook. Culms rigid, wiry; perianth segments with lateral dark-brown bands.—Mt. Sanhedrin and north to British Columbia.

Var. **brunneus** Engelm. Nigger Heads. Panicle usually very short and compact; perianth and capsule dark brown.—Coast form: Eureka, Humboldt Co., *Tracy* 1221; Pt. Benicia, Marin Co., *Michener & Bioletti*; Lobos Creek, San Francisco, *Kellogg*; Palo Alto, *Congdon*; Carmel, *Ferguson* 301.

Refs.—JUNCUS EFFUSUS L. Sp. Pl. 326 (1753), type European. Var. EXIGUUS Fern. & Wieg. Rhod. 12:87 (1910), type loc. Yosemite Valley, *Bolander* 4949. Var. GRACILIS Hook. Fl. Bor. Am. 2:190 (1840), type loc. "N. W. Coast. Columbia. *Douglas. Dr. Scouler.*" Var. BRUNNEUS Engelm. Trans. St. Louis Acad. 2:491 (1868), type loc. salt marshes near San Francisco. Var. *aemulans* Buch. in Engler, Pflzr. 4^{36}:136 (1906).

9. **J. drummondii** E. Mey. (Fig. 39e-g.) Densely caespitose; stems slender, terete, 6 to 15 inches high; inner sheaths bristle-tipped; spathe ½ to ¾ inch long, equaling or exceeding the inflorescence; perianth segments 3 lines long, with brown margins, lanceolate, acute, the inner a little shorter; capsule brown, oblong, retuse, nearly equaling the perianth; seeds ovate, caudate at both ends, brown.

High montane, 7000 to 9000 feet, Sierra Nevada from Tulare Co. to Siskiyou Co. Northward to Alaska; also in the Rocky Mts.

Locs.—Mineral King (acc. Coville); Lake Ahiguita, Madera Co., *Congdon*; Mono Trail, *Bolander* 5096; Calaveras Big Trees, *Hillebrand* 2337; Sonora Pass, *A. L. Grant* 432; Deadman Creek, Tuolumne Co., *Jepson* 6569; Soda Springs Cañon, Kennedy Lake, *A. L. Grant* 483; Mt. Tallac, *Jepson* 8146; Mt. Shasta, *Brewer* 1383. Orca, Alaska, *Jepson* 450.

Refs.—JUNCUS DRUMMONDII E. Mey. in Ledebour, Fl. Ross. 4:235 (1853), type loc. islands of Karäginsk (*Mertens*) and Unalaska (*Chamisso* and *Eschscholtz*); Buch. in Engler, Pflzr. 4^{36}:142, fig. 73 (1906). *J. compressus* var. *subtriflorus* E. Mey. Linnaea, 3:368 (1828), type loc. Unalaska. *J. subtriflorus* Cov. Cont. U. S. Nat. Herb. 4:208 (1893). Var. *humilis* Engelm. Trans. St. Louis Acad. 2:445 (1866), type loc. Mt. Shasta, *Brewer*, is simply a reduced form.

10. **J. parryi** Engelm. (Fig. 39h.) Caespitose; stems filiform, 3 to 6 inches high; inner sheaths leaf-bearing, the leaves sulcate at base, terete above, much shorter than the stems; ligules none or obscure; spathe exceeding the inflorescence, ¾ to 1 inch long; perianth segments 3 lines long, more or less tinged with brown, lanceolate-acuminate, or the inner obtuse; capsule oblong or narrowly oblong, acute, about equaling or a little exceeding the perianth; seeds as in J. drummondii.

Thin soil drift or alpine meadowlets on granite slopes, Sierra Nevada, 6000 to 12,500 feet. Northward to British Columbia, east to the Rocky Mts.

Locs.—Mt. Whitney, *Jepson* 1079; Lake Merced, Yosemite Park, *Jepson* 4408; Little Yosemite, *Jepson* 4399; Lambert Dome, *Jepson* 3250; Silver Lake, Lassen Co., *Baker & Nutting*; Soda Springs Cañon, Kennedy Lake, *A. L. Grant* 491; Mt. Tallac, *Jepson* 8146a; Mt. Shasta, *Jepson*; Medicine Lake, Siskiyou Co., *Goldsmith* 35.

Ref.—JUNCUS PARRYI Engelm. Trans. St. Louis Acad. 2:466 (1866), 491 (1868), type loc. Colorado, *Parry* 360.

11. **J. bufonius** L. TOAD RUSH. (Fig. 40a, b.) Stems 1 to 6 (or rarely to 10 or 14) inches high, terete, branching from the base, leafy; leaves narrow, usually revolute and bristleform; inflorescence a dichotomous cyme; flowers solitary and remote to closely secund or even sub-capitate; perianth-segments 1½ to 2½ lines long, long acuminate, greenish with white scarious margins, exceeding the capsule; capsule oblong, obtuse or truncatish.

A common species in wet places or dried up pools, throughout California. Very variable in size and aspect. Widely spread over the whole earth acc. to Buchenau.

Locs.—Coast Ranges: Yreka, *Butler* 8, 792, 874; Shasta, *F. W. Morse;* Mendocino City, *Bolander*; Ft. Bragg, *W. C. Mathews*; Napa Valley, *Jepson*; Vacaville, *Jepson*; Novato, Marin Co., *Jepson* 9057; Carmel, *Ferguson* 292. Sierra Nevada: Jess Valley, Modoc Co., *Jepson* 7953; Jackson, *Hansen* 627a; Table Mt., Tuolumne Co., *Jepson* 6425; Yosemite, *Jepson* 8368. Southern California: Victorville, *Parish* 10572; Bear Valley, San Bernardino Mts., *Parish;* Strawberry Valley, Mt. San Jacinto, *Hall* 2076; La Mesa, San Diego Co., *Jepson* 6691.

Var. **halophilus** Fern. & Buch. Stems stout, short; inner perianth segments obtuse, little if at all exceeding the capsule.—Santa Cruz Isl. acc. Parish (Muhl. 6:117).

Refs.—JUNCUS BUFONIUS L. Sp. Pl. 328 (1753), type European. Var. HALOPHILUS Fern. & Buch. Rhod. 6:39 (1904), type loc. Quebec.

12. **J. sphaerocarpus** Nees. Very similar to J. bufonius but smaller; stems densely tufted, 1½ to 2 inches high; branches 2 to 4-flowered; perianth segments subequal, equaling or exceeding the perianth; capsule elliptic or "globose."

Moist flats in the valleys or mountains. California east to Arizona and north to Idaho. Rarely collected with us.

Locs.—Shackelford Creek, w. Siskiyou Co., *Butler* 1742; Antioch, *Davy* 948; Bear Valley, San Bernardino Mts., *Parish.*

Ref.—JUNCUS SPHAEROCARPUS Nees, Flora 1:521 (1818).

13. **J. triformis** Engelm. DWARF RUSH. (Fig. 40c.) Stem almost none, bearing several erect filiform scape-like peduncles 2 to 4 inches high; leaves an inch or less long, filiform; flowers usually 3 to 7 in a small head; perianth brownish, 1 to 1½ lines long; segments narrowly lanceolate, acuminate, nearly equal, a little exceeding the 3 stamens and the capsule; capsule obovate, obtuse, apiculate; style exserted with elongated stigmas.

Mountains, 200 to 6200 feet, North Coast Ranges and Sierra Nevada. Infrequent or overlooked. North to Oregon and Washington.

Locs.—Ft. Seward, Humboldt Co., *Tracy* 4431; Lakeport, Lake Co., *Mary K. Curran;* Chowchilla River bed, *Congdon*; North Fork Kings River, *Hall & Chandler* 558. Var. **stylosus** Engelm. (Fig. 40d.) Styles very long.—DeLong's Ranch, Yosemite trail, *Bolander* 4864; Chowchilla River, Mariposa Co., *Congdon*; Lake Merced, Yosemite Park, *Jepson* 4414. Var. **brachystilus** Engelm. (Fig. 40e.) Styles short.—California north to Washington.—Ukiah, *Bolander* 4646; Howell Mt., *Tracy* 1555, 1534A. Var. **uniflorus** Engelm. (Fig. 40f, g.) Plants very small (¾ to 1 inch high); scapes 1-flowered.—Alt. 20 to 6000 feet.—Campo, San Diego Co., *Parish* 10815; Surprise Lake, Mt. San Jacinto, *Reed* 2481; Bear Valley, *Parish* 1859; Vacaville, *Jepson* 1205; Long Valley, Mendocino Co., *Bolander* 4691; Buck Mt. acc. Tracy.

Refs.—JUNCUS TRIFORMIS Engelm. Trans. St. Louis Acad. 2:488 (1868) and 492 (1868), type from California. Var. STYLOSUS Engelm. l.c. 492, type loc. Yosemite Valley, *Bolander.* Var. BRACHYSTILUS Engelm. l.c. 493, type loc. Ukiah, *Bolander*; Buch. in Engler, Pflzr. 4^{36}:258, fig. 119 A–L (1906). Var. UNIFLORUS Engelm. l.c. 493, based on spms. by *Hillebrand* (Sierra Nevada) and *Bolander* (upper Tuolumne River and Anderson Valley). *J. triformis* var. *brachystilus* f. *uniflorus* Buch. l.c. fig. 119 M–Q. *J. saginoides* Engelm. l.c. 493. *J. uncialis* Greene, Pitt. 2:105 (1890), type loc. Suisun, *Greene;* Buch. l.c. fig. 120 (1906).

14. **J. tenuis** Willd. (Fig. 41a, b.) Stems caespitose, slender, erect, 1 to 2 feet high, leafy at base; leaves very fine, shorter than the stem; involucral bract exceeding the loose panicle; perianth segments pale, narrowly lanceolate, acuminate, 1¾ to 2 lines long, spreading in fruit and equaling or usually exceeding the ovate retuse greenish capsule; seeds with a white appendage at each end.

Dry valley flats, 50 to 4200 feet. Southern California north to Oregon. A common species throughout the United States and western Europe.

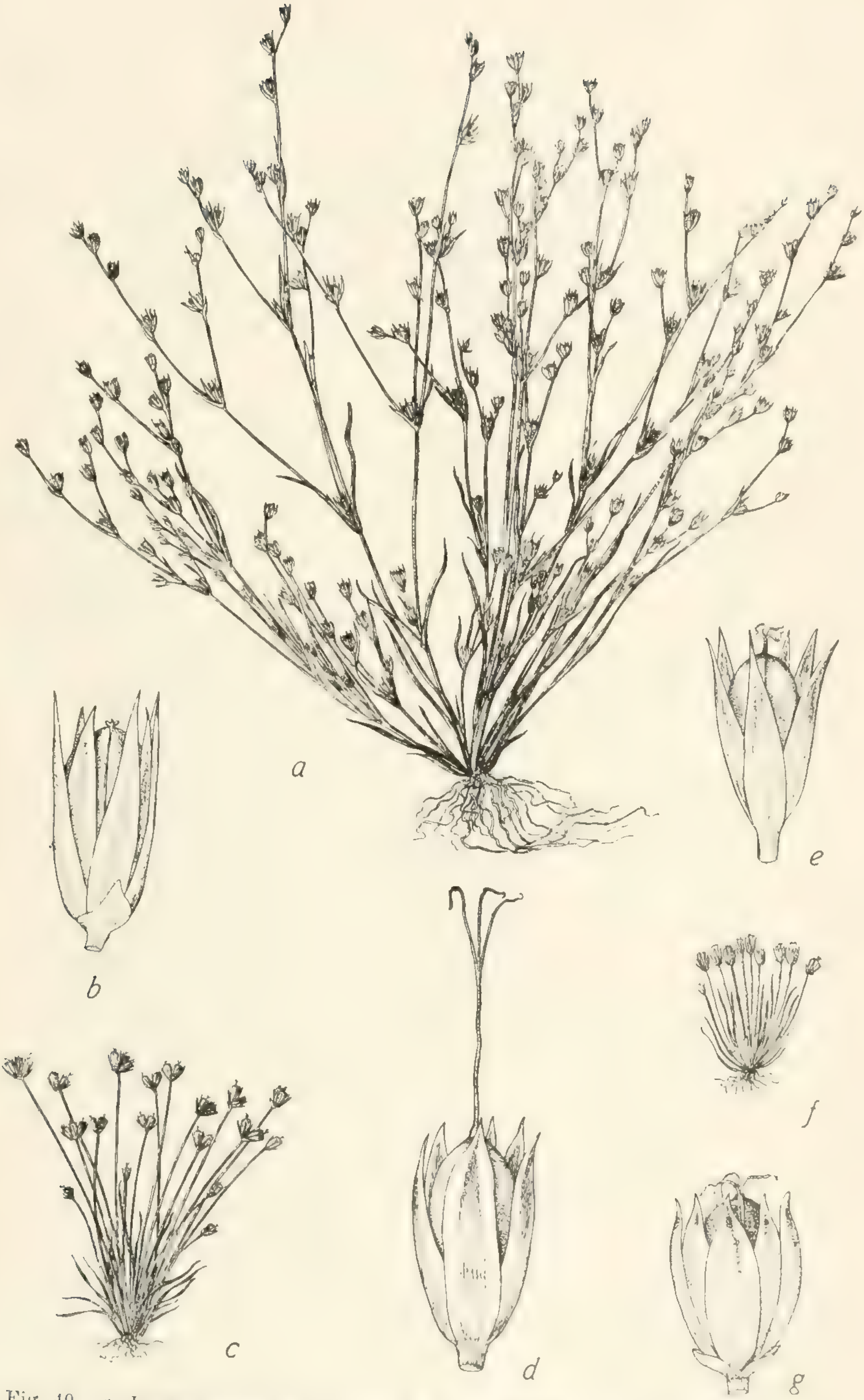

Fig. 40. *a*, JUNCUS BUFONIUS L., habit, × 1; *b*, perianth and capsule, × 9. *c*, J. TRIFORMIS Engelm.; habit, ×1. *d*, var. STYLOSUS Engelm., perianth and capsule, × 9. *e*, var. BRACHYSTILUS Engelm., perianth and capsule, × 9. *f*, var. UNIFLORUS Engelm., habit, × 1; *g*, perianth and capsule, × 10.

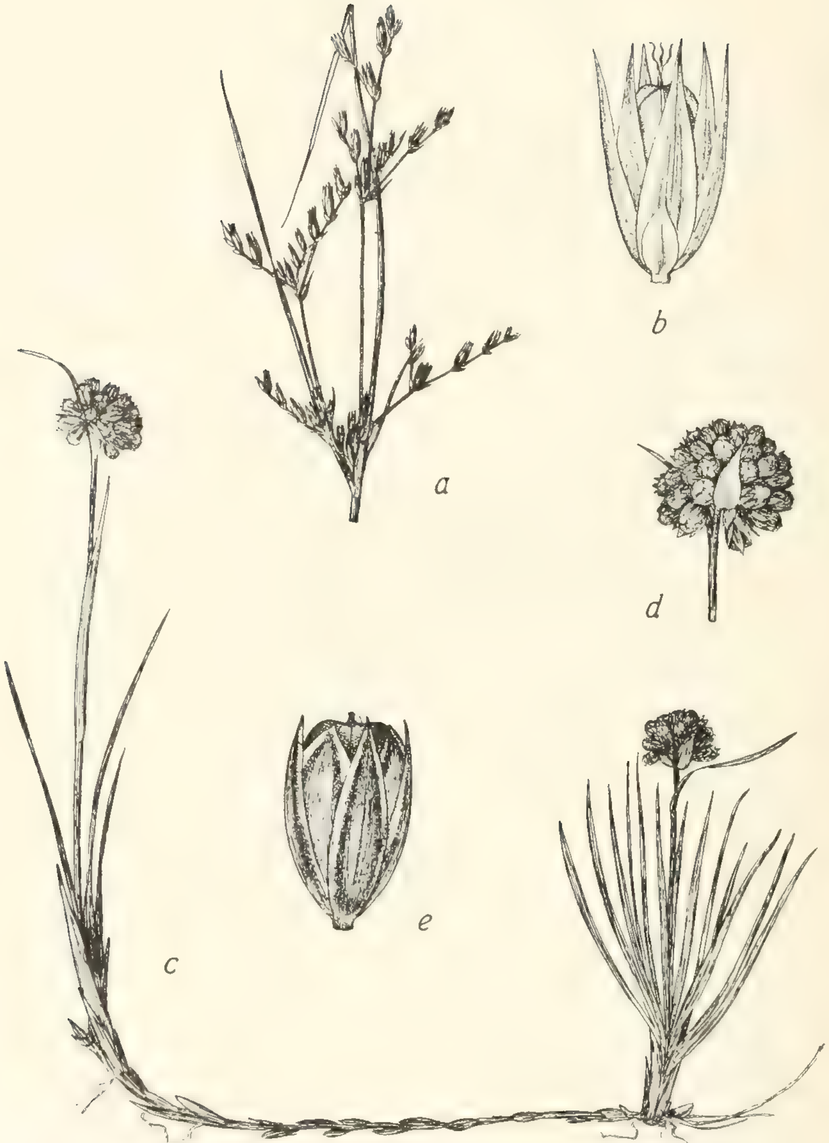

Fig. 41. *a*, Juncus tenuis Willd., inflorescence, × 1; *b*, perianth and capsule, × 7. *c*, J. falcatus E. Mey., habit, × ½; *d*, inflorescence, × 1; *e*, perianth and capsule, × 6.

Locs.—Monterey, *Brewer* 611; Cannon, Solano Co., *Jepson* 6786; Conn Valley, *Jepson* 40a; Anderson Valley, *Bolander* 4809; Eureka, *Tracy* 3749, 3986; Shackelford Creek, w. Siskiyou Co., *Butler* 1697; Shasta Valley, *Butler* 1422; Soulsbyville, *Jepson* 7685; Yosemite Valley, *Jepson* 4392, 8364.

Var. **congestus** Engelm. Inflorescence congested or subcapitate.—Central California coast and middle altitudes in the Sierra Nevada: Eureka, *Tracy* 1172; Hopland, *Jepson* 7626; Santa Rosa, *Heller* 5634; upper Conn Valley, *Jepson* 40b; Alderney, Marin Co., *Jepson* 8269; Carmel, *Ferguson* 296; West Berkeley, *Davy* 748; Yosemite, *Bolander* 6037; Confidence, Tuolumne Co., *Jepson* 7699.

Refs.—JUNCUS TENUIS Willd. Sp. Pl. 2:214 (1799), type loc. Boreal America. Var. CONGESTUS Engelm. Trans. St. Louis Acad. 2:450 (1866), based on spms. from San Francisco (*Bolander*), Monterey (*Brewer*), and Colorado (*Hall*). *J. tenuis* var. *occidentalis* Cov. Proc. Biol. Soc. Wash. 10:129 (1896). *J. occidentalis* Wiegand, Bull. Torr. Club, 27:521 (1900).

15. **J. falcatus** Mey. (Fig. 41c-e.) Stems subterete or a little compressed, 6 to 9 inches high, more or less leafy, terete; rootstock slender, creeping; leaves usually equaling or exceeding the stems, 1½ lines wide, not ribbed by transverse septa; flowers in dense many-flowered terminal heads, the heads usually solitary; involucral bract about equaling the inflorescence; perianth segments 2 lines long, roughened, dark brown, with a broad green midvein; capsule triangularly ovate, obtuse, mucronate; seeds large (½ line long), with a whitish or as if membranous coat.

Coast region, in sand-dunes or sandy soil, from Monterey Co. to Humboldt Co. North to Alaska; Japan, Australia.

Locs.—Santa Cruz Mts., *Brewer* 1581; Lone Mt., San Francisco, *Bolander;* Samoa sand-dunes near Eureka, *Tracy* 1273. Unalaska, *Jepson* 226.

Refs.—JUNCUS FALCATUS Mey. Syn. 34 (1823), type loc. Monterey, *Haenke*. Var. PANICULATUS Engelm. Trans. St. Louis Acad. 2:495 (1868), type loc. Mendocino, *Bolander*; heads smaller, in a panicle. *J. covillei* Piper, Contr. U. S. Nat. Herb. 11:182 (1906).

16. **J. obtusatus** Engelm. (Fig. 42a-c.) Stems subterete or a little compressed, 4 to 10 inches high, from a creeping rootstock, a little surpassing or about equaling the narrow (1 line broad) leaves; sheaths without ligules; involucral bract exceeding the inflorescence; heads 3 to 5-flowered, few in a simple panicle; perianth segments 1½ to 2 lines long, of equal length, the outer ovate, acute, brown margined, the inner very obtuse, white-scarious margined, shorter than the capsule; capsule oblong-ovate, obtuse or truncate, shortly apiculate.

Sandy banks of mountain streams, North Coast Ranges, 200 to 4000 feet; Sierra Nevada, 4000 to 9600 feet (reported only from the central region); San Bernardino Mts. North to Washington.

Locs.—Hydesville, Humboldt Co., *Tracy* 2122; Dinsmore Ranch, Buck Mt., *Tracy* 2871; Buck Mt., Humboldt Co., *Tracy* 3915; Grouse Creek, Humboldt Co., *Chesnut & Drew*; Thistle Sprs., Mt. Sanhedrin, *Heller* 5994; Lake Co., *A. B. Simonds*; Sonora Pass, *A. L. Grant* 346; Kennedy Mdw., Tuolumne Co., *A. L. Grant* 448a; Big Creek, Big Oak Flat road to Yosemite, *Jepson* 8346; San Bernardino Mts. (acc. Parish, Pl. World 20:178).

Refs.—JUNCUS OBTUSATUS Engelm. Trans. St. Louis Acad. 2:495 (1868), type loc. Mariposa Big Trees, *Bolander*; Buch. in Engler, Pflzr. 4^{36}:246, fig. 115 (1906).

17. **J. canaliculatus** Engelm. Stems stout, terete, 2 to 3⅓ feet high; herbage pale; leaves concave or channeled, almost equaling the stem; ligules present; panicle open, with 8 to 30 heads; heads 3 to 8 (or 12)-flowered; perianth light greenish red, 2½ lines long, the inner segments distinctly longer; anthers red-brown; style long, the stigmas long exserted; capsule ovate, beaked.

Stony stream banks or damp soil, from the foothills to 7500 feet, cismontane Southern California, and desert slope of the San Bernardino Mts. Arizona, Lower California.

Locs.—Claremont, acc. Parish; Twin Creek Falls, San Bernardino, *Parish* 3962; Little Bear Valley, acc. Parish; Witch Creek, acc. Parish.

Refs.—JUNCUS CANALICULATUS Engelm. Bot. Gaz. 7:6 (1882), type loc. Mill Creek Cañon. San Bernardino Mts., 4000 feet, *S. B. & W. F. Parish* 1095; Parish, Muhl. 6:125 (1910). *J. macrophyllus* Cov.; Hall, Univ. Cal. Publ. Bot. 1:65 (1902).

18. **J. longistylis** Torr. Stems tall (1 to 2 feet high), subterete or slightly compressed; leaves shorter than the stems, the sheaths with ligules; heads densely

(usually 2 to 6)-flowered in a short sparingly branched panicle, exceeding the very short involucral bract; perianth pale, segments of equal length, narrow, acuminate, broadly scarious-margined, 2 lines long; styles long; capsule equaling the perianth, triangular ovate, obtuse, mucronate.

Crest and eastern side of the Sierra Nevada from Mariposa Co. north. New Mexico, Colorado and Nebraska north to Saskatchewan.

Locs.—Mono Lake, *Bolander* 6029; Kennedy Mdw., Tuolumne Co., *A. L. Grant* 125, 448a; Sonora Pass, *A. L. Grant* 272; ne. Modoc Co., *Manning* 441.

Ref.—JUNCUS LONGISTYLIS Torr. Bot. Mex. Bound. 223 (1859), type loc. "Copper Mines," New Mexico, *Bigelow*.

19. **J. latifolius** Buch. (Fig. 42d, e.) Similar to J. longistylis; leaves narrowly linear-lanceolate, 2 to $3\frac{1}{2}$ lines broad, 2 to 5 inches long; ligules absent; heads 6 to 10-flowered, in a loose simple few-headed panicle.

Sierra Nevada from Tulare Co. north to Siskiyou Co.; also Oregon and Washington. More ample material may show that this is better disposed as a variety of J. longistylis.

Locs.—Yosemite Valley, *Bolander* 6035; Sonora Pass, *A. L. Grant* 272; Tallac, *Jepson* 8081; Pilgrim Creek, McCloud Flat, *Goldsmith* 1; Medicine Lake, *Goldsmith* 30; Goosenest foothills, *Butler* 872 (leaves very narrow).

Refs.—JUNCUS LATIFOLIUS Buch. Monogr. Juncae. 425 (1890). *J. longistylis* var. *latifolius* Engelm. Trans. St. Louis Acad. 496 (1868), based on spms. by Bolander from Yosemite Valley (6035), upper Tuolumne River, and east slope of the Sierra Nevada. *J. orthophyllus* Cov. Contrib. U. S. Nat. Herb. 4:207 (1893).

20. **J. supiniformis** Engelm. Early leaves elongated and capillary, floating, pale green, 1 to 2 feet long; stems low, erect, terete, shorter than the subterete cauline leaves; panicle simple, its 3 to 6 small heads about 5-flowered; perianth segments brownish, narrowly lanceolate, acute, nerved, $1\frac{1}{2}$ to 2 lines long.

In ponds, Mendocino and Humboldt cos. North to Washington.

Ecolog. Note.—"In spring these ponds [at Mendocino City] are completely covered with the pale green capillary leaves of this species, 1 or 2 feet long. As the water recedes with the advancing dry season, the erect flowering stems begin to form, and a little later the vestiges of the decayed vernal leaves cover the remaining mud with grayish spiderweb-like filaments."—H. N. Bolander.

Locs.—Mendocino coastal plain, *Bolander* 4767b; Humboldt Co. (acc. Buchenau in Engler, Pflzr. 4^{36}:174).

Ref.—JUNCUS SUPINIFORMIS Engelm. Trans. St. Louis Acad. 2:461 (1868), type loc. Mendocino City, *Bolander* 4767.

21. **J. mertensianus** Bong. (Fig. 42f, g.) Stems very slender, compressed, from slender matted rootstocks, 3 to 6 (or 11) inches high; leaves very narrow, rather flattened, less than 1 line wide, finely but obscurely ribbed by transverse septa, the sheaths with ligules; heads solitary, densely many-flowered, dark brown; perianth 1 to $1\frac{1}{2}$ lines long, the lanceolate narrowly acuminate segments equaling the obtuse obovoid capsule; anthers usually shorter than the filaments; seeds obliquely obovate, apiculate at apex, stipitate at base.

Higher mountains, 4000 to 11,000 feet: San Bernardino Mts.; Sierra Nevada north to Modoc Co., thence west to Del Norte Co. North to Alaska and east to Colorado.

Locs.—Mill Creek Falls, San Bernardino Mts., *Parish* 2522; Mt. Silliman, *Ralph Hopping* 425; Mono Pass, *Bolander* 6039; Herring Creek, Tuolumne Co., *A. L. Grant* 108; Heather Lake, El Dorado Co., *Jepson* 8169; Sonora Pass, *A. L. Grant* 310, 418; ne. Modoc Co., *Manning* 466; Ash Creek, Mt. Shasta, *M. S. Baker*; Lake Earle, Del Norte Co., *Davy*. Unalaska, *Jepson* 92, 176.

Refs.—JUNCUS MERTENSIANUS Bong. Mem. St. Petersb. ser. 6, 2:167 (1833), type loc. Sitka, Alaska, *Mertens*; Buch. in Engler, Pflzr. 4^{36}:201, fig. 96 (1906).

22. **J. nevadensis** Wats. (Fig. 43a-c.) Resembling slender forms of J. phaeocephalus: stems very slender, somewhat compressed, from a slender creeping

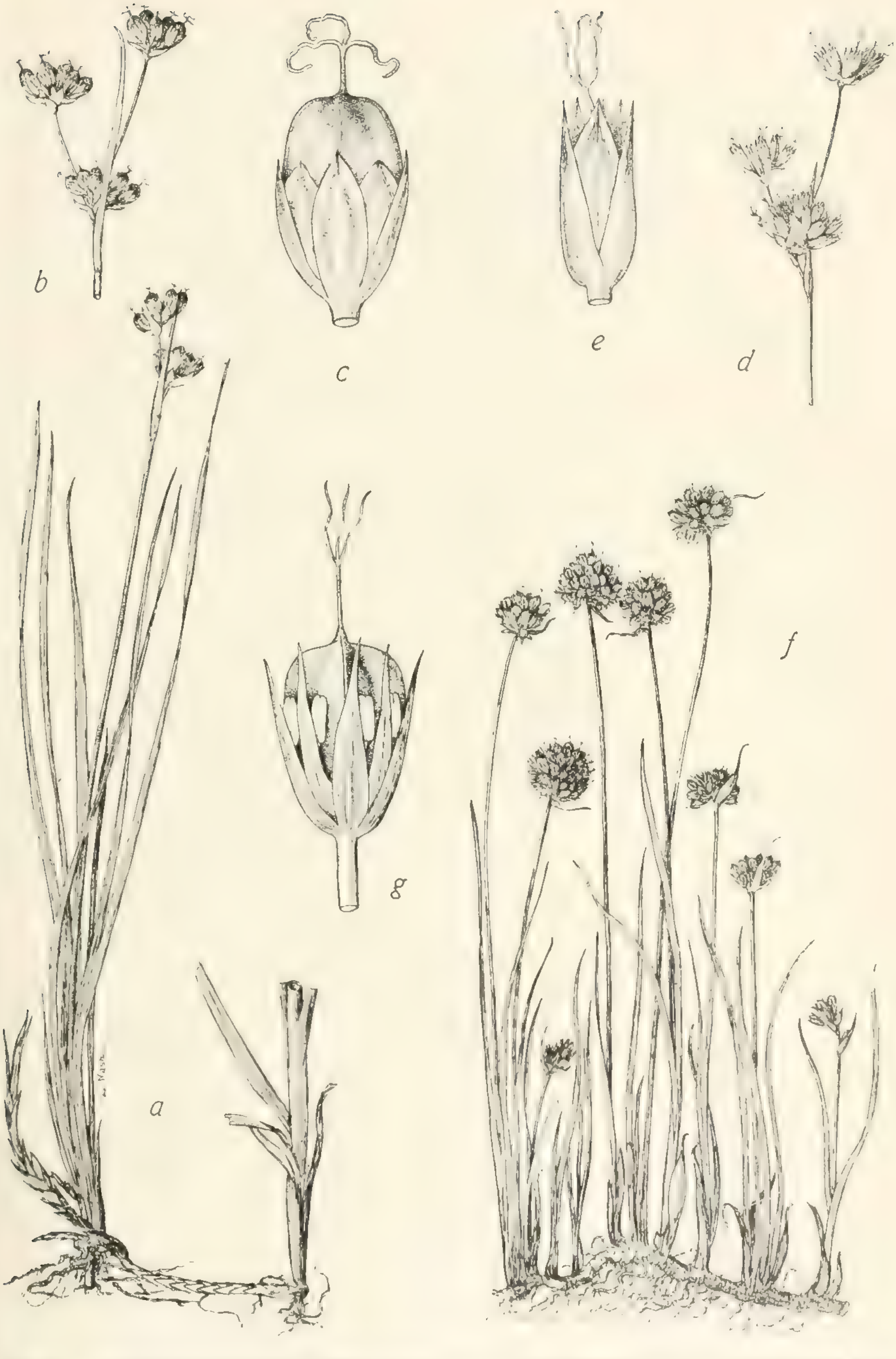

Fig. 42. *a*, JUNCUS OBTUSATUS Engelm., habit, × 1; *b*, inflorescence, × 1; *c*, perianth and capsule, × 6. *d*, J. LATIFOLIUS Buch., inflorescence, × 1; *e*, perianth and capsule, × 6. *f*, J. MERTENSIANUS Mey., habit, × 1; *g*, perianth and capsule, × 9.

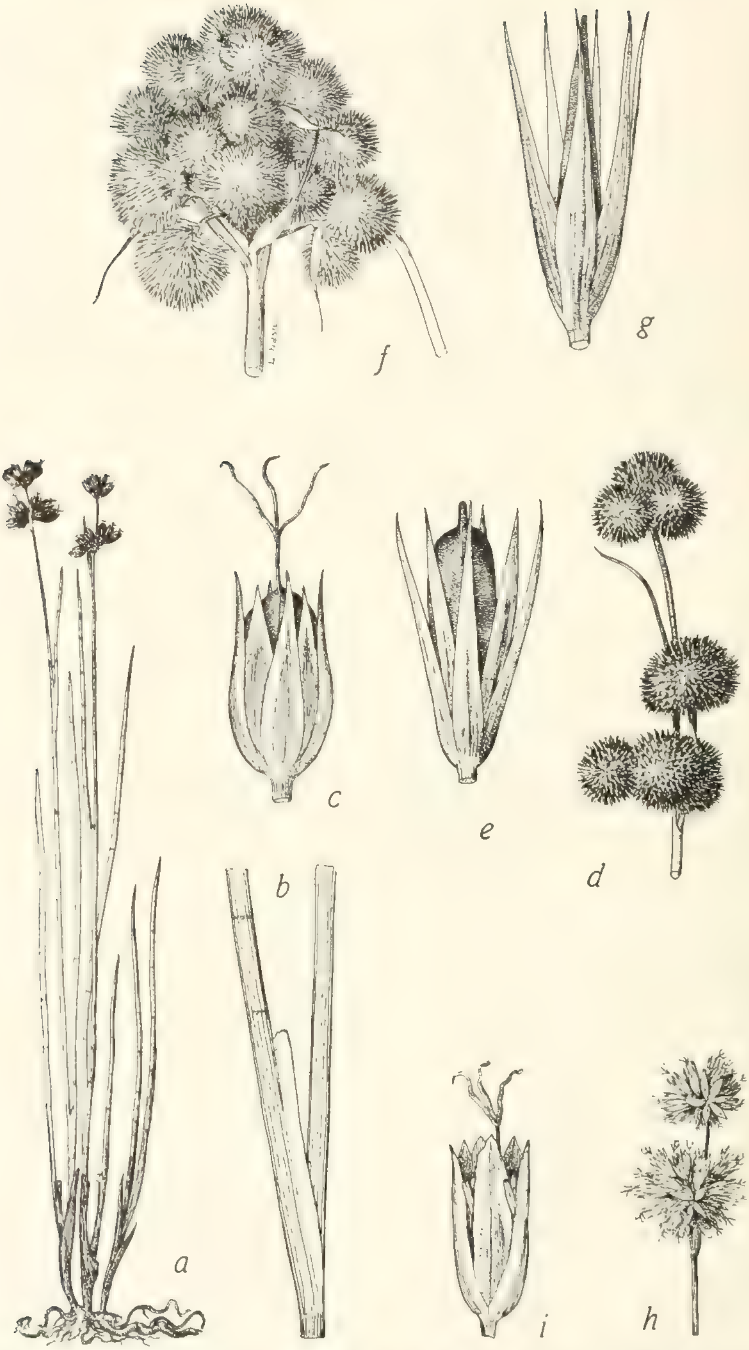

Fig. 43. *a*, JUNCUS NEVADENSIS Wats., habit, × ½; *b*, detail of leaf with ligule, × 3; *c*, perianth and capsule, × 6. *d*, J. BOLANDERI Engelm., inflorescence, × 1; *e*, perianth and capsule, × 10. *f*, J. TORREYI Cov., inflorescence, × 1; *g*, perianth and capsule, × 5. *h*, J. CHLOROCEPHALUS Engelm., inflorescence, × 1; *i*, perianth and capsule, × 5.

rootstock, ½ to 1 (or sometimes 2) feet high; leaves teretish, very narrow (¼ to ½, rarely 1 line), more or less distinctly knotted by internal transverse partitions; ligules present; heads small, 2 to 7 in a short open panicle, sparsely flowered; perianth segments very dark brown, lanceolate, acuminate, 1½ to 2 lines long; anthers longer than the filaments; stigmas long exserted; capsule oblong, abruptly acute and beaked, nearly equaling the perianth.

Higher mountains, 5000 to 9000 feet: Sierra Nevada; south to the San Jacinto and San Bernardino mountains. North to British Columbia. Marked by its very narrow and erect strongly septate leaves with prominent ligules.

Locs.—Round Valley, Mt. San Jacinto, *Charlotte M. Wilder* 924; Bear Valley, San Bernardino Mts., *Parish* 3788; Volcano Creek, upper Kern River, *Hall & Babcock* 5425; Tuolumne Soda Sprs., *Bolander* 5062; Yosemite trail, *Bolander* 6041; Eagle Peak Mdws., Yosemite, *Jepson* 4375; Stanislaus Peak, *A. L. Grant* 527; Tahoe, *Jepson* 7736; Sierra Valley, *Hall & Babcock* 4477; Honey Lake Valley, *Davy* 3279; Dixie Valley, Lassen Co., *Baker & Nutting;* Willow Creek, Modoc Co., *Baker & Nutting*; Joseph Creek, Warner Mts., *Smith* 110; Medicine Lake, *Goldsmith* 35a (det. Coville). Brockway, Lake Tahoe, Nev., *Jepson* 7750.

Refs.—JUNCUS NEVADENSIS Wats. Proc. Amer. Acad. 14:303 (1879); Buch. in Engler, Pflzr. 4^{36}:203, fig. 97 (1906). *J. phaeocephalus* var. *gracilis* Engelm. Trans. St. Louis Acad. 2:209 (1868), based on spms. from the Mariposa Grove (*Bolander, Hillebrand*), upper Tuolumne River (*Brewer* 1709, 1760, 2339, *Bolander* 5062), and Mono Pass, *Bolander* 6013. *J. aseptus* Engelm.; Parish, Muhl. 6:123 (1910), type loc. Bear Valley, San Bernardino Mts., *Parish* 1439.

23. **J. bolanderi** Engelm. (Fig. 43d, e.) Stems slender, terete, 1 to 2¾ feet high, a little exceeding or about equaling the terete strongly septate leaves; ligules of the sheaths conspicuous; heads subglobose, very dark, usually 2 or 3 in a close cluster, very many flowered; perianth segments reddish brown, narrowly lanceolate, acuminate and setaceous, 1½ lines long, exceeding the capsule; capsule clavate-oblong, obtuse, apiculate; seeds obovate, apiculate at each end.

Swamps, North Coast Ranges. North to southwestern Oregon.

Locs.—Crescent City, *Davy* 5942; Humboldt Co. (acc. Buchenau in Engler, Pflzr. 4^{36}:186); Comptche, *Harriet Walker* 348; Ft. Bragg, *W. C. Mathews* 211; Ukiah, *Heller* 5837; Elk Mt., n. Lake Co., *Tracy* 2284; *Asti*, Sonoma Co., *Jepson* 7648; Glen Ellen, Sonoma Co., *Bioletti*.

Var. **riparius** Jepson n. var. Heads smaller, lighter-colored, 5 to 9 in a loose panicle; perianth segments less setaceous.—Lower Sacramento River near Rio Vista, *Jepson* 29a.

Refs.—JUNCUS BOLANDERI Engelm. Trans. St. Louis Acad. 2:436 (1866), 470 (1868), type loc. Mendocino City, *Bolander*. Var. RIPARIUS Jepson.

24. **J. torreyi** Cov. (Fig. 43f, g.) Tall coarse plants with slender creeping rootstocks; stems stout, terete, 1¼ to 2 feet or more high; leaves terete, straight and rigidly spreading, the transverse septa very distinct; ligules present; inflorescence terminal; flowers many in large dense heads which form a compact capitate cluster or condensed panicle, the cluster subtended by a long pointed sheath; perianth light brown, 4 to 5 lines long, its segments lanceolate-subulate, exceeding the narrow pointed golden capsule.

Damp places, Southern California. East to Texas, thence far east to the Atlantic and north to British Columbia. Well distinguished by its large dense heads, by its very narrow and rigid perianth segments and by its slender golden capsule.

Locs.—Los Angeles River, *Braunton* 559; Orange, *S. B. & W. F. Parish* 1593; San Bernardino Valley, *Parish* 7153; Dixieland, Imperial Valley, *Parish* 9039; Mecca, *Parish* 8619; Silver Cañon, White Mts., *Jepson* 7418; Bakersfield (acc. Coville).

Refs.—JUNCUS TORREYI Cov. Bull. Torr. Club 22:303 (1895). *J. nodosus* L. var. *megacephalus* Torr. Fl. N. Y. 2:326 (1843), type loc. shores of Lake Ontario, *Gray;* Cov. U. S. Nat. Herb. 4:207 (1893). *J. megacephalus* Wood, Classbook Bot. ed. 2:724 (1861), not Curtis.

25. **J. chlorocephalus** Engelm. (Fig. 43h, i.) Stems low and slender (8 to 15 inches high), terete, from a slender rootstock; leaves narrow (less than a line wide), the sheaths with ligules; heads 1 or 2, many flowered; perianth pale and

scarious; segments 2 lines long, obtuse or acute; style exserted; capsule shorter than the perianth.

Sierra Nevada, 6400 to 8400 feet, from Nevada Co. to Mariposa Co.

Locs.—Donner Pass, *Heller* 7178; Fallen Leaf, El Dorado Co., *Hall* 8776; Eagle Mdw., Tuolumne Co., *A. L. Grant* 378; Cascade Creek, upper Stanislaus River, *Jepson* 6530; Kennedy Lake, *A. L. Grant* 205; Lake Tenaya, Yosemite, *Hall* 3636; Yosemite Falls, *Bolander;* Little Yosemite, *Jepson* 3161.

Ref.—JUNCUS CHLOROCEPHALUS Engelm. Trans. St. Louis Acad. 2:485 (1868), type loc. "higher mts. of California" (= Sierra Nevada), *Hillebrand* 2338.

26. **J. dubius** Engelm. (Fig. 44a-c.) Stems very slender, compressed, 2 to 4 feet high, from stout horizontal rootstocks; leaves narrow (1 line broad) but rigid, ⅔ to nearly as long as the stems, coarsely septate; panicle compound, diffuse, 3 to 12 inches long; heads 6 to 20-flowered, numerous; perianth brown or brownish, 1½ to 2 lines long, the segments lanceolate, acuminate; anthers elongated, rather exceeding the filaments; capsule narrowly oblong, acuminate, slightly longer than the perianth; seeds abruptly apiculate at each end, reticulate, brownish.

Mariposa Co. to Sierra Co. The leaves suggest diminutive bamboo fishing rods.

Locs.—Yosemite Valley, *Jepson* 100a; Sierra Valley, *Jepson* 8043. A local and little known species, known to us in typical form only from Mariposa and Sierra cos. but probably occurring elsewhere in the Sierra Nevada, especially southward. It is similar in aspect to J. oxymeris but the leaves are narrow and compressed, very strongly or even coarsely septate, and the sheaths are ligulate. The following do not have the leaves coarsely septate nor as rigid as in the type, but agree otherwise: Hetch-Hetchy, *Jepson* 3416; Middle Camp, Tuolumne Co., *A. L. Grant* 4 (det. Coville); Yankee Hill, Columbia, *Jepson* 6453.

Ref.—JUNCUS DUBIUS Engelm. Trans. St. Louis Acad. 2:459 (1868), type loc. Mariposa Big Trees, *Bolander* 6032.

27. **J. rugulosus** Engelm. (Fig. 44d, e.) Very closely allied in habit and character to J. dubius; stems stouter, 1½ to 3 feet high, sharply and minutely transverse-rugulose; leaves strongly septate, attenuate into a flagellate-filiform tip; panicle 4 to 9 inches long; heads small, 4 to 6-flowered; perianth 1¼ to 1½ lines long, its segments oblong-lanceolate, acuminate; filaments 1½ to 2 times as long as the anthers; capsule oblong and acuminate, or lanceolate or broadly subulate, prismatically and sharply triangular, slightly exceeding the perianth.

Damp meadow land or marshes, southern Mohave Desert through the valleys of cismontane Southern California to San Diego. This differs from J. dubius, aside from the wrinkled epidermis, only in the relative length of the anthers which is not an absolute character.

Locs.—Victorville, *Parish* 10564; Lone Pine Cañon, n. slope San Gabriel Mts., *Abrams & McGregor* 686; San Bernardino Valley, *Parish* 6947; Los Angeles River, *Braunton*; Long Beach, *E. Bethel*; Balona Ranch, San Diego Co., *S. B. & W. F. Parish* 1416.

Ref.—JUNCUS RUGULOSUS Engelm. Bot. Gaz. 6:224 (1881), type loc. south foot of San Bernardino Mts., *W. G. Wright.*

28. **J. oxymeris** Engelm. Stems 1 to 2 feet high, compressed, somewhat angled, erect, from an elongated horizontal rootstock, often stoloniferous; leaves broad and flat, equitant (1½ or) 2 to 3 lines wide, ligules not present, transverse partitions not conspicuous; involucral bract short; heads 5 to 10-flowered, set singly in a loose panicle; perianth segments brownish, linear-lanceolate, subulate, of equal length or the interior slightly longer; anthers 6, longer than the filaments; styles long exserted; capsule long attenuate, exceeding the perianth; seeds small, obovate, apiculate, light brown and finely reticulate.

Moist valleys and mountain flats, Coast Ranges and Sierra Nevada, 50 to 6000 feet. North to Oregon.

Locs.—Scott Valley, Lake Co., *Tracy* 2381; lower Sacramento River near Rio Vista, *Jepson* 30a; Confidence, Tuolumne Co., *Jepson* 7701; Mariposa Big Trees, *Bolander* 6031.

Ref.—JUNCUS OXYMERIS Engelm. Trans. St. Louis Acad. 2:483 (1868), type loc. Sacramento Valley, *Hartweg* 322.

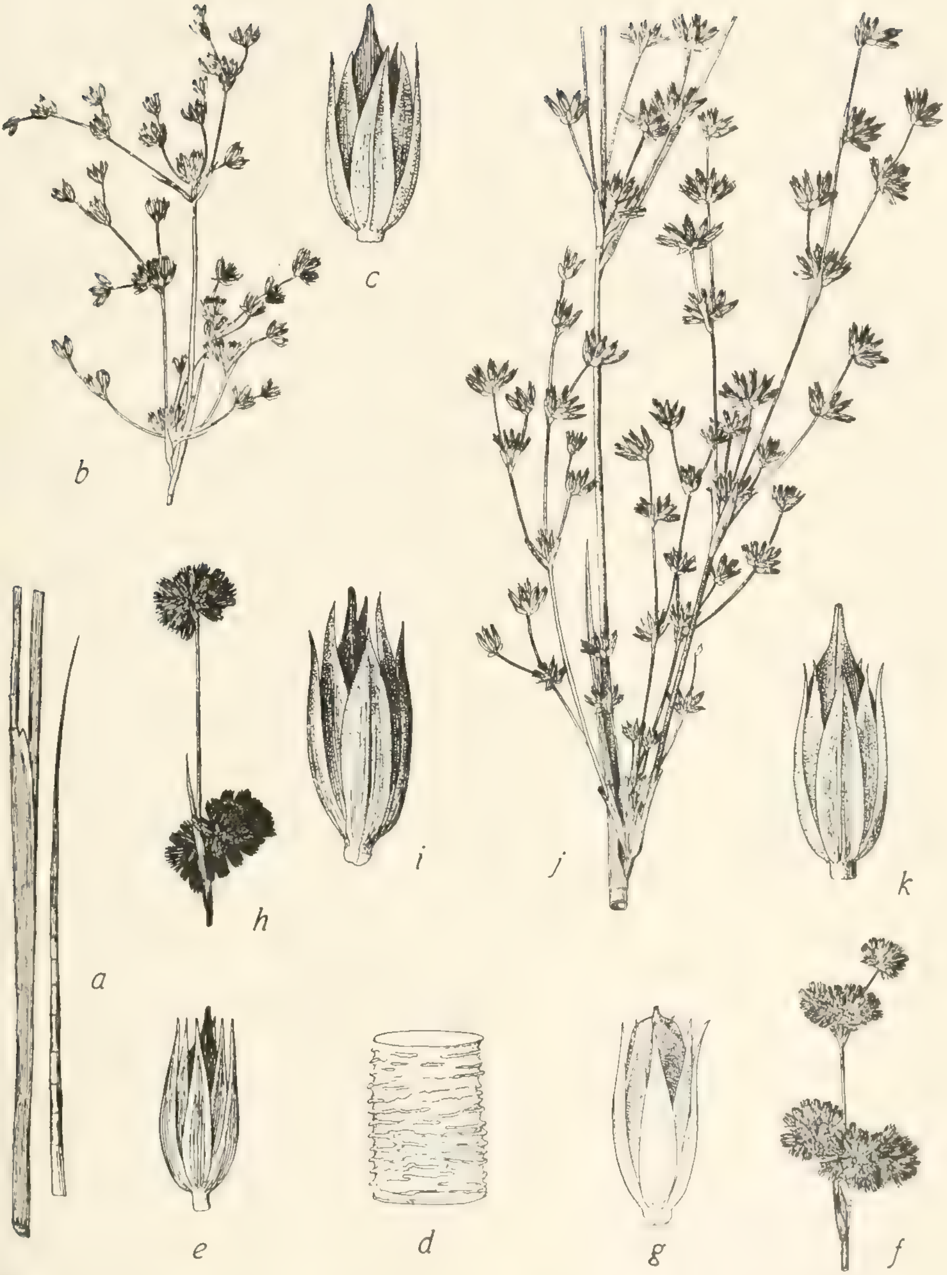

Fig. 44. *a*, JUNCUS DUBIUS Engelm., detail of leaf with ligule, × 1; *b*, inflorescence, × 1; *c*, perianth and capsule, × 8. *d*, J. RUGULOSUS Engelm., detail of stem, × 8; *e*, perianth and capsule, × 8. *f*, J. XIPHIOIDES E. Mey., inflorescence, × 1; *g*, perianth and capsule, × 8. *h*, J. PHAEOCEPHALUS Engelm., inflorescence, × 1; *i*, perianth and capsule, × 8. *j*, var. PANICULATUS Engelm., inflorescence, × 1; *k*, perianth and capsule, × 7.

29. **J. xiphioides** Mey. (Fig. 44 f, g.) Stems ancipital, 1½ to 3 feet high; leaves equitant, more or less obviously septate, 1½ to 2½ lines wide, 6 to 14 inches long; panicle 2½ to 7 inches long; heads 6 to 11-flowered, discrete or more or less congested; perianth segments lanceolate, subulate-acuminate, the inner a little shorter than the outer; stamens 6; stigmas barely exserted; capsule narrowly cylindric, abruptly acute or somewhat beaked, equaling or exceeding the perianth; seeds narrowly ovoid, apiculate.

Coastal region, salt marshes and moist lands. Southern California to Humboldt Co. and north to Oregon.

Locs.—Malibu Cañon, Los Angeles Co., *Barber*; Victorville, *Parish* 10568; East Oakland, *Harriet Walker* 660 (infl. congested); Berkeley, *Jepson* 8188; Stege, *Davy* 4076; Laribee Creek, Humboldt Co., *Tracy* 4671; North Fork Eel River near north border Mendocino Co., *Goddard* 636; Honey Lake Valley, *Jepson* 7794.

Var. **auratus** Engelm. Stems slender, lower; heads yellow.—Central California: Suisun marshes, *Jepson* 3a; Mt. Diablo, *Brewer* 838; Saratoga, *Davy* 293 (transition to species).

Refs.—JUNCUS XIPHIOIDES Mey. Syn. Jun. 50 (1823), type loc. Monterey, *Haenke*. Var. *littoralis* Engelm. Trans. St. Louis Acad. 2:481 (1868), the typical coast form. Var. AURATUS Engelm. l.c., type loc. Mt. Diablo, *Brewer*.

30. **J. ensifolius** Wikstr. Similar to J. xiphioides; stems 1 to 2 feet high; heads fewer, dense, dark-colored, many-flowered, 3 to 4 lines broad; perianth larger, dark brown, equaling the acute capsule; stamens mostly 3 (sometimes 6).

Wet granitic gravel, Sierra Nevada, 4000 to 9600 feet, north to Siskiyou Co., thence southwesterly to Mendocino Co. Far north to Alaska.

Locs.—Merced Big Trees, *Hall & Babcock* 3415; Kennedy Mdws., Tuolumne Co., *A. L. Grant* 116; Soda Springs Cañon, Kennedy Lake, Tuolumne Co., *A. L. Grant* 475, 480; Sonora Pass, *A. L. Grant* 145; Strawberry, Tuolumne Co., *Jepson* 6504; Eagle Lake, *Baker & Nutting*; Jess Valley, Modoc Co., *Jepson* 7954, 7985; Oro Fino, Siskiyou Co., *Butler* 1784; Quartz Valley, Siskiyou Co., *Butler* 1832; White Thorn Valley, s. Humboldt Co., *Tracy* 5027; Ft. Bragg, *W. C. Mathews* 156, 160. Unalaska, *Jepson* 276.

Refs.—JUNCUS ENSIFOLIUS Wikstr. Vet. Akad. Handl. Stockh. 2:274 (1823), type loc. Unalaska. *J. xiphioides* var. *triandrus* Engelm. Trans. St. Louis Acad. 2:481 (1868), type loc. Yosemite Valley, *Bolander* 6026.

31. **J. phaeocephalus** Engelm. (Fig. 44h, i.) Stems ⅔ to 1½ feet high, erect, leafy, ancipitally compressed, not winged, arising from stout elongated rootstocks; leaves ½ to 1½ lines wide, compressed, equitant, ribbed by transverse septa, sometimes very distinctly so; ligules none; flowers in terminal heads, the inflorescence usually barely exceeding the leaves; heads 1 to 3, solitary or 2 in a place; perianth dark brown, 1½ to 2 lines long; style long; stigmas exserted; capsule long acuminate, equaling or slightly exceeding the perianth; seeds ovoid, the longitudinal ridges connected by similar transverse ones.

Meadows and borders of swamps, coast region from Los Angeles Co. to Mendocino Co. and north to Oregon.

Locs.—Los Angeles, *Hasse*; Carmel, *Ferguson* 291; Pajaro hills, *Chandler*; Lake Pilarcitos, San Mateo Co., *Davy* 756; Belmont, *Davy* 751; Lone Mt., San Francisco, *Kellogg*; Peralta Park, Berkeley, *Davy*.

Var. **paniculatus** Engelm. (Fig. 44j, k.) Stems 1 to 3 feet high from a stout rootstock; heads few-flowered, many to numerous in a loose compound panicle; perianth segments very dark; styles long-exserted.—Valleys and mountain flats, Coast Ranges, Sierra Nevada, and cismontane Southern California.

Locs.—Tauquitz Valley, Mt. San Jacinto, *Jepson* 2311; San Bernardino Valley, *Parish* 2029; South Fork Santa Ana River, *Hall* 7609; Huckleberry Mdw., Kaweah River basin, *Hopping* 416; Warm Springs, Alameda Co., *Jepson* 100b; Alviso, *Elmer*; Berkeley, *Davy* 753; Alderney, Marin Co., *Jepson* 8266; Vacaville, *Jepson* 4244 (det. F. V. C.).

Refs.—JUNCUS PHAEOCEPHALUS Engelm. Trans. St. Louis Acad. 2:484 (1868), type loc. central California sea-coast; Buch. in Engler, Pflzr. 4^{36}:178, fig. 88 (1906). Var. *glomeratus* Engelm. l.c. the usual form of the species. Var. PANICULATUS Engelm. l.c. type loc. Napa Valley, *Bigelow*.

2. LUZULA DC. WOODRUSH

Plants of dry or high ground in open or shady or sometimes moist places. Stems hollow, leafy, simple, slender. Leaves softer and flatter than in Juncus, grass-like and often hairy or villous. Flowers in umbels or panicles or crowded in dense clusters or spikes. Capsule 1-celled; seeds 1 to 3.—Species 61, temperate and cold regions of all continents, but most abundant in the northern hemisphere. (Latin lucus, wood or grove, the habitat of certain species.)

Flowers solitary at the ends of the branches of the inflorescence.
  Pedicels divaricate..........1. *L. divaricata.*
  Pedicels erect..........2. *L. parviflora.*

Flowers crowded in spikes or dense clusters.
  Leaves flat.
    Bracts and bractlets conspicuously fimbriate or ciliate..........3. *L. subcongesta.*
    Bracts and bractlets not fimbriate.
      Flowers in mostly rayed clusters..........4. *L. campestris.*
      Flowers in mostly solitary sessile spikes..........5. *L. subsessilis.*
  Leaves channeled; flowers in a dense nodding spike-like panicle..........6. *L. spicata.*

1. **L. divaricata** Wats. (Fig. 45a, b.) Stems 6 to 12 inches high, nearly naked, the leaves in a mostly basal tuft; herbage quite glabrous; inflorescence a diffuse cyme with divaricate branches and pedicels.

Sierra Nevada, 7,000 to 11,000 feet. Nevada.

Locs.—Donner Pass, *Heller* 7138; Placer Co., *Carpenter*; Yosemite Park, *H. M. Evans*; Sawtooth Peak, *Hall & Babcock* 5690. Mt. Rose, Nev., *Kennedy.*

Ref.—LUZULA DIVARICATA Wats. Proc. Am. Acad. 14:302 (1879), type loc. northern Sierra Nevada (above Mono Lake, *Brewer* 1794, 2069, 2334; Sierra Co., *Greene, Lemmon*).

2. **L. parviflora** Desv. Stems 1 to 2⅓ feet high, usually rather leafy, densely leafy at base; leaves hairy at the sheaths; inflorescence lax, the branches of the cyme somewhat slender or racemose, distinctly though not strongly drooping; perianth-segments greenish, acute, cuspidate, shorter than the acute shortly-beaked reddish capsule.

Coniferous woods, Sierra Nevada, far North Coast Ranges. North to Alaska, thence east to Labrador. Europe.

Locs.—Coast Ranges: between Requa and Crescent City, *Davy;* Dinsmore Ranch, Van Duzen River Valley, *Tracy* 2877; Eureka, *Tracy* 810; North Fork Coffee Creek, *Goldsmith* 19; Shackelford Creek, w. Siskiyou Co., *Butler* 1673; Widow Creek, Mt. Shasta, *Goldsmith.* Sierra Nevada: McCloud, *Goldsmith* 9; Whitney Mdws. (acc. Coville).

Var. **fastigiata** Buch. Inflorescence more or less corymbose; branches slender, only slightly or scarcely at all drooping.—Sierra Nevada: Yosemite Creek, *Hall & Babcock* 3458; Dinkey Big Trees, *Hall & Chandler* 371.

Refs.—LUZULA PARVIFLORA Desv. Jour. Bot. 1:144 (1808). *Juncus parviflorus* Ehrh. Beitr. 6:139 (1791), type European. *Juncoides parviflorum* Cov. Contr. U. S. Nat. Herb. 4:209 (1893). Var. FASTIGIATA Buch. Krit. Verz. Juncaceen 83 (1880). *L. melanocarpa* Desv. var. *fastigiata* E. Mey. Linnaea 3:374 (1828), type loc. Unalaska.

3. **L. subcongesta** Jepson n. comb. (Fig. 45c-e.) Similar in habit to L. parviflora; pedicels very much shortened and the flowers in capitate clusters at the ends of the branches of the cyme; bracts and bractlets fimbriate; perianth dark reddish-brown, merely acute or membranously pointed; capsule dark or black.

Grassy spots amongst granite rocks, northern Sierra Nevada, 7,000 to 8,000 feet.

Locs.—Sonora Peak, *A. L. Grant* 415; Donner Pass, *Heller* 7135.

Refs.—LUZULA SUBCONGESTA Jepson. *L. spadicea* var. *subcongesta* Wats. Bot. Cal. 2:202 (1880), type loc. Donner Lake, *Torrey, Greene.* *Juncoides subcongestum* Cov. Muhl. 1:105 (1904). *J. subcapitatum* Heller, Bull. Torr. Club 31:401 (1904).

4. **L. campestris** DC. COMMON WOOD-RUSH. (Fig. 46a-e.) Stems erect, leafy, 8 to 15 inches high; herbage sparsely villous; leaf-blades 3 to 6 inches long, 2 to 3 lines wide, flat, villous at the throat and sparsely so on the margins; bract foliaceous, shorter than or usually much exceeding the inflorescence; flowers

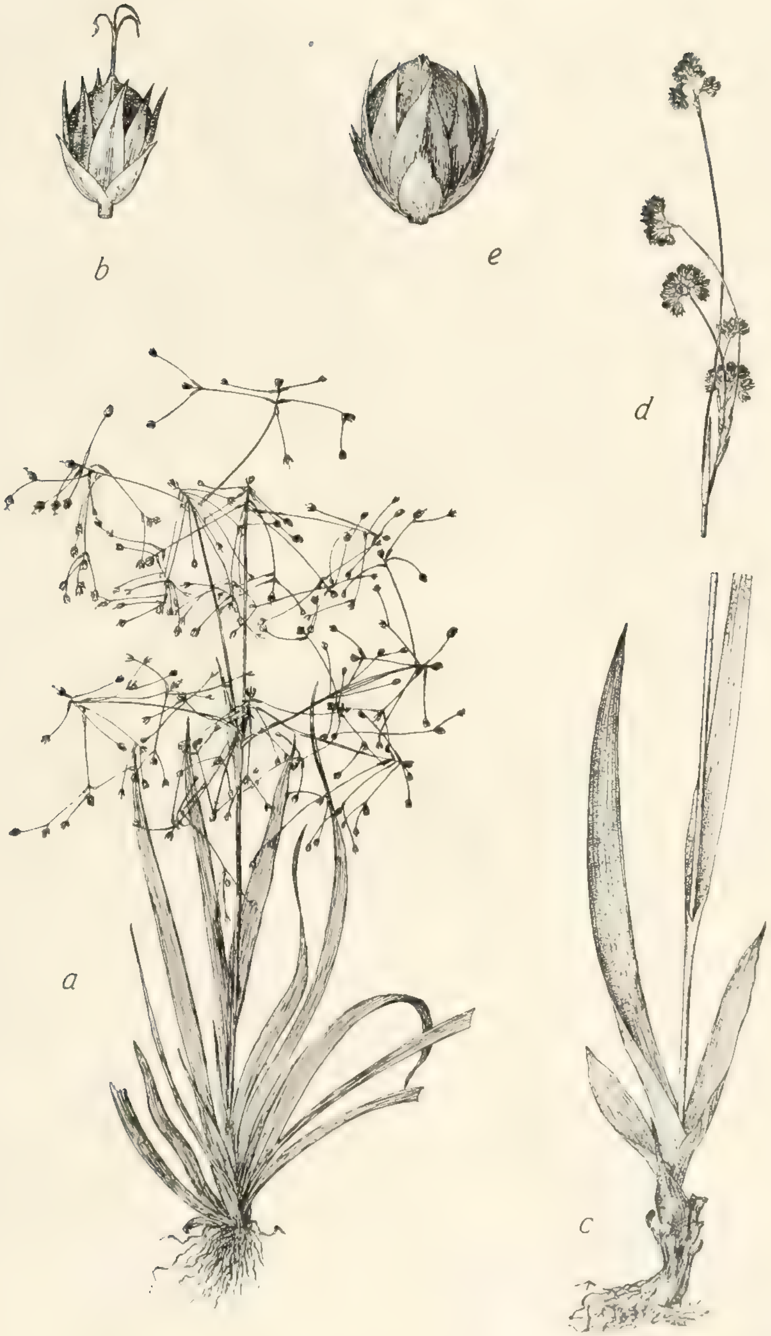

Fig. 45. *a*. Luzula divaricata Wats., habit, × ½; *b*, perianth and capsule, × 8. *c*, L. subcongesta Jepson, lower portion of plant, × 1; *d*, inflorescence, × 1; *e*, perianth and capsule, × 10.

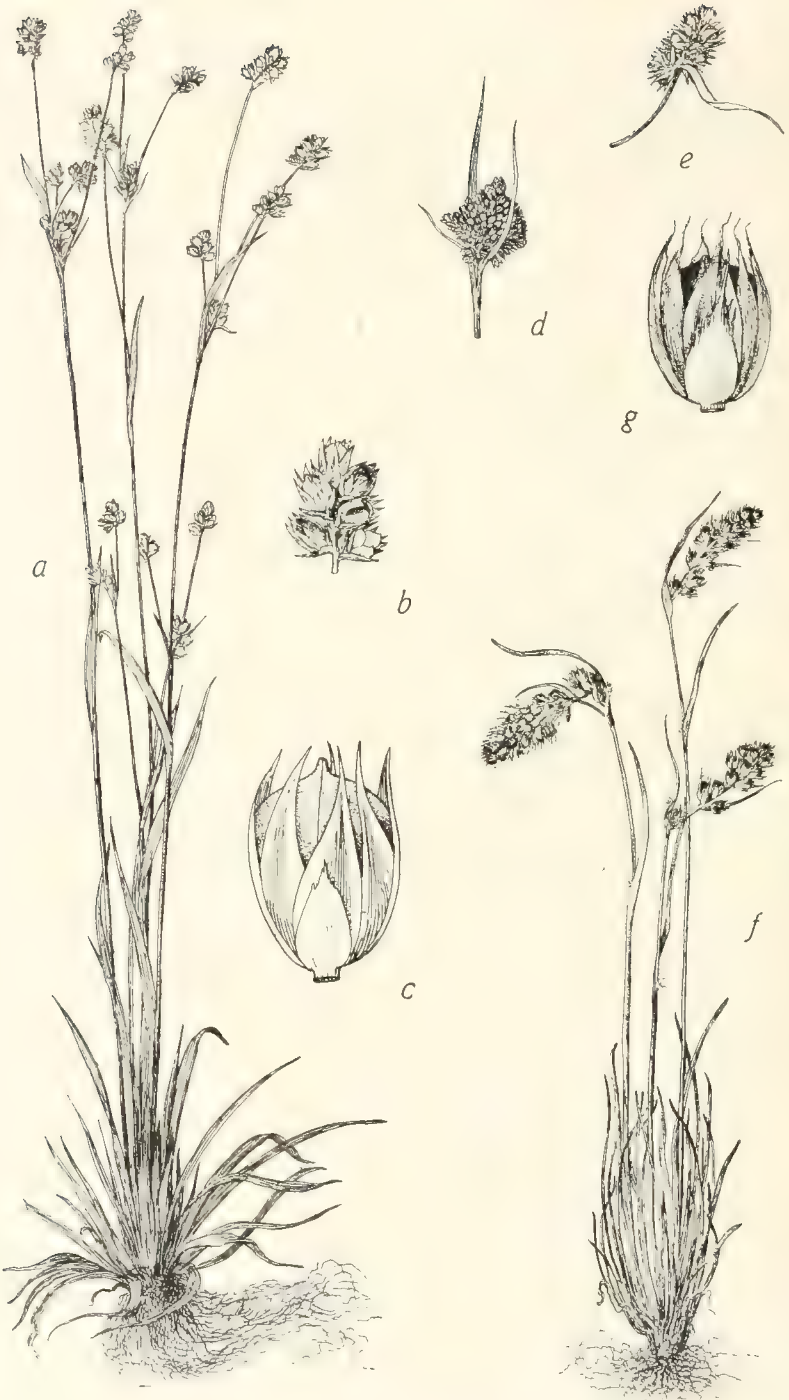

Fig. 46. *a*, LUZULA CAMPESTRIS DC., habit, × ½; *b*, inflorescence, × ½; *c*, perianth and capsule, × 8. *d*, var. CONGESTA Mey., inflorescence, × ½. *e*, L. SUBSESSILIS Buch., inflorescence, × 1. *f*, L. SPICATA, DC., habit, × 1; *g*, perianth and capsule, × 10.

spicate; spikes 3 to 4 lines long, erect, cymosely disposed, some on rays $\frac{1}{4}$ to 1 (or 2) inches long, some subsessile; bractlets scarious, hyaline and ciliate above; perianth segments lanceolate, acuminate, $1\frac{1}{2}$ lines long, tinged with dark brown; seed dark, with a whitish conical appendage at one end $\frac{1}{4}$ to $\frac{1}{2}$ as long.

Partially shaded spots, mountain and coast regions of California, 100 to 6000 feet. North America, Europe, Asia.

Locs.—Mt. San Jacinto, *Hall* 2460; Kaweah River Valley, acc. Coville (Contrib. U. S. Nat. Herb. 4:208); Italian Bar, Tuolumne Co., *A. L. Grant* 24; Calaveras Co., *Blasdale;* Eight Mile, Wawona road, *Jepson* 4292; Little Yosemite, *Jepson* 4405; Lake Merced, Yosemite Park, *Jepson* 4425; Big Creek, Big Oak Flat road, *Jepson* 8347; Cascade Creek, Tuolumne Co., *Jepson* 6531; Lassen Co., *Baker & Nutting;* Pine Creek, Big Valley Mountains, *Baker & Nutting;* Medicine Lake, *Goldsmith;* Shackelford Creek, w. Siskiyou Co., *Butler* 1701; Eureka, *Tracy* 1087; Conn Valley, *Jepson;* Martinez, *Chandler* 851; Berkeley, *Davy;* Alameda, *Bioletti;* Angel Isl., *Davy* 6912; Pacific Grove, *Davy* 7493. Unalaska, *Jepson* 55.

Var. **congesta** Buch. (Fig. 46d.) Spikes several, congested into a pyramidal or conical head; perianth often dark-brown.—California coast: Pacific Grove, *Heller* 6467; Lake Merced, San Francisco, *Davy;* Inverness, *Jepson* 8304; Eureka, *Tracy* 3642.

Var. **sudetica** Celak. Inflorescence congested; perianth almost black.—Mineral King acc. Coville. Europe.

Refs.—LUZULA CAMPESTRIS DC. Fl. Fr. 3:161 (1805). *Juncus campestris* L. Sp. Pl. 1:329 (1753), type European. *Luzula comosa* Mey. Syn. Luz. 21 (1823); Jepson, Fl. W. Mid. Cal. 95 (1901); var. *macrantha* Wats. Bot. Cal. 2:203 (1880), no station given; perianth $2\frac{1}{2}$ lines long.—San Bernardino Mts. acc. Parish, Pl. World 20:178. *Juncoides campestre* Ktze. Rev. Gen. Pl. 722 (1891). Var. CONGESTA Buch. Monog. Juncac. 162 (1890). *L. comosa* var. *congesta* Wats. Bot. Cal. 2:203 (1880). Var. SUDETICA Celak. Prodr. Fl. Böhm. 749 (1881). *Juncoides campestre* var. *sudeticum* Cov. Contrib. U. S. Nat. Herb. 4:208 (1893). *Juncus sudeticus* Willd. Sp. Pl. 2:221 (1799), type loc. Silesia.

5. **L. subsessilis** Buch. (Fig. 46e.) Erect or ascending, 5 to 12 inches high; spikes solitary or rarely 2 in a place, sessile or nearly so, $2\frac{1}{2}$ to 4 lines long.

Central California coast. North to British Columbia.

Loc.—Olema, *Davy* 4320.

Refs.—LUZULA SUBSESSILIS Buch. Osterr. Bot. Zeitschr. 290 (1898). *L. comosa* var. *subsessilis* Wats. Bot. Cal. 2:203 (1880), type loc. not given.

6. **L. spicata** DC. (Fig. 46f, g.) Densely tufted, 4 to 12 inches high, without rootstocks; leaves narrowly linear, channeled; flowers in sessile clusters, forming a spike-like panicle; panicle nodding, sometimes interrupted, $\frac{1}{2}$ to $\frac{3}{4}$ inch long; perianth segments bristle-pointed, equaling or exceeding the bluntly acute capsule.

High mountains, Sierra Nevada, 9,000 to 12,500 feet. North to Alaska, east to New England. Europe, Asia.

Locs.—Mt. Whitney, *Jepson* 1090; Mineral King (acc. Coville, Contrib. U. S. Nat. Herb. 4:209); Lake of Lone Indian, Fresno Co., *A. L. Grant* 1547; Soda Springs Cañon, Kennedy Lake, *A. L. Grant* 541.

Refs.—LUZULA SPICATA DC. Fl. Fr. 3:161 (1835). *Juncus spicatus* L. Sp. Pl. 330 (1753). *Juncoides spicatum* Ktze. Rev. Gen. Pl. 725 (1891).

LILIACEAE. Lily Family

Perennial herbs, the stems from bulbs or rootstocks, or rarely shrubs or trees. Leaves all basal and the stem a scape, or the stem more or less leafy and frequently branching. Flowers regular and perfect; perianth with 6 segments or lobes, the 3 outer and 3 inner petaloid and alike (or nearly) in shape and color, or sometimes strongly differentiated; when strongly differentiated by shape or color the outer 3 are called sepals and the inner 3 petals. Stamens 6, sometimes 3 or 4. Ovary superior, 3-celled; styles 3, or 1 and entire or 3-cleft; stigmas 3, rarely 1. Fruit a capsule or berry.—Maianthemum has a 2-merous flower, Scoliopus a 1-celled ovary, Veratrum polygamous flowers, and Smilax dioecious flowers. Cauline leaves alternate, or sometimes whorled in Fritillaria and Lilium, netted-veined and whorled in Trillium.—About 200 genera and 2500 species; all continents. The genus Odontostomum is peculiar to California, while Chlorogalum, Bloomeria and Scoliopus are almost restricted to its limits. There are about 88 species and 23 varieties peculiar to California, chiefly in Allium, Brodiaea and Calochortus.

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A. Fruit a capsule.

1. PERENNIAL HERBS.

- Styles 3 and distinct (except no. 1); plants with rootstocks (except nos. 4 and 5); perianth-segments distinct.
  - Leaves equitant.
    - Stamens with densely woolly filaments; flowers in a loose raceme..........1. NARTHECIUM.
    - Stamens not woolly; flowers in a head or capitate raceme..........2. TOFIELDIA.
  - Leaves not equitant.
    - Stem glabrous, the leaves mostly basal.
      - Perianth-segments not glandular.
        - Leaves very dry and sedge-like, rough-edged; flowers not nodding..........3. XEROPHYLLUM.
        - Leaves not sedge-like; flowers nodding..........4. STENANTHIUM.
      - Perianth-segments glandular near the base..........5. ZYGADENUS.
    - Stem pubescent (at least above), very leafy..........6. VERATRUM.
- Style 1, entire, or 3-lobed or 3-parted, or none; plants with bulbs (except no. 7).
  - Stems from a tunicated bulb or corm.
    - Flowers with bracts.
      - Flowers in racemes or panicles.
        - Perianth-segments united below into a tube.
          - Flowers in a cluster on the ground; anthers basifixed..........7. LEUCOCRINUM.
          - Flowers borne on a more or less leafy stem.
            - Perianth-segments ascending; anthers versatile..........8. HESPEROCALLIS.
            - Perianth-segments reflexed; anthers basifixed..........9. ODONTOSTOMUM.
        - Perianth-segments distinct, withering-persistent; leaves basal; anthers versatile.
          - Flowers in a raceme.
            - Raceme dense; perianth 2½ to 5 lines long..........10. SCHOENOLIRION.
            - Raceme loose; perianth about 1 inch long..........11. CAMASSIA.
          - Flowers in a panicle..........12. CHLOROGALUM.
      - Flowers in umbels or heads.
        - Perianth-segments distinct or nearly so; anthers versatile.
          - Filaments not appendaged, often dilated at base.
            - Umbel in the bud sheathed by a continuous spathe splitting into 2 or 3 bracts; bractlets none..........13. ALLIUM.
            - Umbel in the bud covered by 3 distinct bracts; pedicels with minute bractlets..........14. MUILLA.
          - Filaments arising from a cup-like or winged appendage..........15. BLOOMERIA.
        - Perianth-segments united below into a tube; stamens with anthers 6 or 3; anthers basifixed or versatile..........16. BRODIAEA.

Flowers without bracts; leaves 1 or few, basal or mostly so; anthers basifixed.
Perianth-segments unlike, the inner very showy, usually with a glandular pit at base; leaves narrow ....17. CALOCHORTUS.
Perianth-segments alike or nearly so, colored alike, without glandular pits; leaves broad ....18. ERYTHRONIUM.
Stems from a scaly bulb.
Perianth campanulate; anthers attached at base or below the middle; style 3-cleft or rarely entire ....19. FRITILLARIA.
Perianth funnelform; anthers versatile; style entire........20. LILIUM.

2. SHRUBS OR TREES.

Flowers rather large; fruit not winged........21. YUCCA.
Flowers minute; fruit 3-winged........22. NOLINA.

B. Fruit a berry (except nos. 29 and 30); plants with rootstocks.

Flowers perfect; stems not prickly.
Leaves reduced to scales; branchlets filiform........23. ASPARAGUS.
Leaves foliaceous.
Plants with leafy stems; stamens 6.
Stem branching; flowers few, drooping.
Flowers axillary; filaments short, flattened........24. STREPTOPUS.
Flowers terminal; filaments thread-like........25. DISPORUM.
Stem simple; flowers many or numerous in a terminal raceme or panicle........26. SMILACINA.
Plants with only 2 or 3, or at most few leaves.
Leaves, or at least one of them, basal, parallel-veined.
Perianth-segments and stamens 4; leaves 2 or 3........27. MAIANTHEMUM.
Perianth-segments 6.
Stamens 6; leaves about 5........28. CLINTONIA.
Stamens 3; leaves 2........29. SCOLIOPUS.
Leaves 3 in a single whorl at summit of stem, netted-veined; flower 1; stamens 6. 30. TRILLIUM.
Flowers dioecious; stems prickly; leaves with climbing tendrils........31. SMILAX.

1. NARTHECIUM Moeh. BOG ASPHODEL

Stems scape-like, with a dense tuft of basal leaves borne on a creeping rootstock. Leaves narrowly linear and equitant, the cauline few and small. Flowers yellowish-green, in a terminal raceme. Pedicels with a bractlet at the middle. Perianth with 6 distinct segments. Stamens 6, the filaments densely woolly, except at the very base. Ovary attenuate upward to the scarcely lobed stigma. Capsule loculicidal, with thin-chartaceous walls. Seeds numerous with a long bristle-like point at each end.—Species 4, northern hemisphere. (Narthex, Greek name of Ferula, the stems of which were used as rods; applied here on account of the scapose stems.)

1. **N. californicum** Baker. Stems 18 to 22 inches high; basal leaves iris-like, 4 to 10 inches long, 1½ to 2 lines wide, the cauline 2 or 3, 1 to 4 inches long; raceme loose, 3½ to 7 inches long; perianth-segments oblong-linear, narrowed upward or acute, 3 to 4 lines long; anthers brick-red; ripe capsules salmon-color; seeds, including the points or tails, 5 lines long.

Marshy ground: North Coast Ranges from Mendocino Co. to Del Norte and Trinity cos.; Sierra Nevada from Plumas Co. to Fresno Co. Southwestern Oregon.

Locs.—Swift Creek, Salmon Mts., *Hall* 8681; Butterfly Valley, Plumas Co., *R. M. Austin;* Nevada Co., *Carpenter*; Heather Lake, El Dorado Co., *Laura Dodge*; Le Conte Falls, Tuolumne Cañon, *F. M. Reed*; Grouse Creek, LeConte Cañon, Middle Fork Kings River, acc. *Pearson*. East Fork Illinois River, Josephine Co., Ore., *Jepson*.

Ref.—NARTHECIUM CALIFORNICUM Baker, Jour. Linn. Soc. 15:351 (1877), type loc. Red Mt., nw. Mendocino Co., *Bolander* 6548.

2. TOFIELDIA Huds.

Stems simple, naked above, arising from a slender rootstock. Leaves linear, sedge-like, equitant, mostly in a basal tuft. Flowers small, greenish white, ours borne by 3s in a head or dense capitate raceme. Pedicels (in ours) with a membranous 3-lobed involucre above the middle or at the summit. Perianth-segments 6, distinct, spreading, persistent. Stamens 6. Ovary 3-lobed; styles 3, short, distinct. Capsule obovate, acute, beaked by the spreading persistent styles, septicidal. Seeds with a membranous coat, in ours tailed at one end.—Species about 15, mostly North Temperate Zone, a few in the Andes. (Tofield, English botanist, of Doncaster, a correspondent of Hudson.)

1. **T. occidentalis** Wats. Stems ½ to 2 feet high, glandular; leaves 2 to 12 inches long, 1 to 3 lines wide; racemes ½ to 1 inch long; perianth-segments oblong, 1½ to 3 lines long; filaments lanceolate; capsule 3 to 4 lines long; seeds with a loose cellular coat, appendaged at the free end with a tail as long or somewhat longer than the body.

Mountain bogs, 3500 to 7500 feet: North Coast Ranges from Mendocino Co. north to Siskiyou Co., thence southerly in the Sierra Nevada. North to British Columbia.

Locs.—North Coast Ranges: Mendocino Co.; Trinity Summit, *Manning;* Dorleska, Salmon Mts., *Hall* 8658; Onion Patch, w. Siskiyou Co., *Jepson* 2879; Shackelford Creek, w. Siskiyou Co., *Butler* 1702; Sisson, *Jepson.* Sierra Nevada: Lassen Peak, *Chesnut & Drew*; Colby, Butte Co., *R. M. Austin*; Heather Lake, El Dorado Co., *Laura Dodge*; Nellie Lake, Fresno Co., *A. L. Grant* 1085; Lake Independence, *Jepson* 8050; Alta Mdws., Sequoia Park, *Hopping* 194; Little Kern River, *Purpus* 5232.

Refs.—TOFIELDIA OCCIDENTALIS Wats. Proc. Am. Acad. 14:283 (1879), type loc. Mendocino Co., *Kellogg & Harford* 1002; MacBride, Contrib. Gray Herb. 49:48 (1917). The involucre varies with age and otherwise from deeply to shallowly lobed in such a way as to give no character for segregation of a series of specimens; in a similar manner the capsular beaks may be either erect or spreading. Therefore, neither *T. glutinosa* Wats. Bot. Cal. 2:184 (1880) nor *T. intermedia* Rydb. Bull. Torr. Club, 27:528 (1900) indicate specific entities in California. All California specimens examined show but a single tail to the seed.

3. **XEROPHYLLUM** Michx.

Stem simple, stout and leafy, ending above in a many-flowered raceme, and arising from a tuber-like woody rootstock bearing cord-like roots, the basal leaves in a dense tuft, numerous, narrowly linear and elongated, dry, rough-edged. Flowers white or cream-color, on slender white pedicels. Perianth-segments 6, distinct, several-nerved, persistent. Stamens 6. Ovary 3-lobed; styles 3, distinct. Capsule chartaceous, loculicidal, or occasionally also septicidal. Seeds 2 to 4 in each cell.—Species 3, North America. (Greek xeros, dry, and phullon, leaf, the foliage very hard and dry.)

1. **X. tenax** Nutt. ELK GRASS. FIRE-LILY. Stem 2 to 6 feet high; basal leaves 1¼ to 3 feet long, 1 to 3 lines wide; raceme dense, ½ to 1½ feet long; pedicels 1 to 2 inches long, each with a scarious bract at base, spreading in flower, past anthesis strictly erect, spreading again in fruit; perianth-segments linear-oblong, 4 lines long, the stamens a little longer.

Dry ridges: Monterey and northward in the Coast Ranges to Del Norte Co., where it is very common; Sierra Nevada from Placer Co. north to Siskiyou Co. North to British Columbia and Montana.

The plants commonly bloom only after 5 to 7 years of preparation. May-July. The fibres of the leaves were employed by the Hupas and other native tribes for making garments and for decorative work in baskets, while the bulbous rootstocks furnished a nourishing food after being roasted in a pit for two days. Also called Squaw-grass, Bear grass, Turkey-beard, Bear-Lily, and Pine-Lily.

Locs.—Mt. Tamalpais (a heavy flowering in May, 1915); Sonoma, *Bioletti*; Ft. Bragg, *W. C. Mathews*; South Fork Mt., Humboldt Co., *Chesnut & Drew*; Preston Peak, *Jepson* 2873; Shelley Creek, Del Norte Co., *Jepson*; Mt. Eddy, *Copeland* 3872; Placer Co., *M. M. Hardy.*

Refs.—XEROPHYLLUM TENAX Nutt. Gen. 1:235 (1818); Jepson, Erythea, 6:75 (1898), Fl. W. Mid. Cal. 123 (1901). *Helonias tenax* Pursh, Fl. 1:243 (1814), type loc. Collins Creek, Ida., *Lewis. Xerophyllum setifolium* Lindl. Bot. Reg. t. 1613 (1833), not Michx.

4. STENANTHIUM Kunth.

Stem from a tunicated bulb, the narrow leaves mostly basal. Flowers (in ours) in a simple raceme, nodding. Perianth purplish green, its segments narrow, acuminate. Stamens 6, much shorter than and inserted on the base of the perianth-segments; anthers reniform, 1-celled. Ovary ovoid; styles 3. Capsule septicidal, 3-beaked. Seeds winged.—Species 5. North America and Asia. (Greek steno, narrow, and anthos, flower.)

1. **S. occidentale** Gray. Stem 6 to 11 inches high; leaves linear, tapering to base and apex, 4 to 7 inches long, 2 to 7 lines wide; perianth narrow-campanulate, 5 lines long, its tips recurved.

High-montane in Trinity Co. North to Alberta.

Loc.—Union Creek, Salmon Mts., *Hall* 8626; only record for California.

Refs.—STENANTHIUM OCCIDENTALE Gray, Proc. Am. Acad. 8:405 (1873), type loc. n. Rocky Mts., *Bourgeau*. *Stenanthella occidentalis* Rydb. Bull. Torr. Club, 27:531 (1900).

5. ZYGADENUS Michx. Zygadene

Stem simple, scape-like, in ours from a tunicated bulb. Outer coats of the bulb mostly dark or black. Herbage glabrous and somewhat glaucous. Leaves linear, mostly basal. Flowers erect, greenish-white, in a raceme or panicle. Perianth nearly rotate, withering-persistent; segments ovate to oblong-lanceolate, with a green glandular spot at the narrow or shortly clawed base. Stamens 6, free from the segments and about equaling them. Styles 3, distinct, persistent. Capsule deeply 3-lobed.—Species 11, North America and Asia. (Greek zugon, a yoke, and aden, a gland.)

Raceme narrow, simple; inner segments spathe-like, the margins abruptly infolded just above the claw.......1. *Z. venenosus.*
Raceme broader, more or less compound.
  Perianth-segments with central area slightly depressed, the border more or less undulate; lower flowers often staminate; bracts membranous.
    Leaves narrow (3 to 5 lines wide); stamens longer than or equaling the perianth; anthers yellow.......2. *Z. paniculatus.*
    Leaves 3/4 to 1 inch wide; stamens shorter than the perianth; anthers white.......3. *Z. exaltatus.*
  Perianth-segments plane; flowers generally all perfect.
    Segments ovate-lanceolate, the outer not clawed; bracts more or less green, conspicuous.......4. *Z. fremontii.*
    Segments broadly elliptic, all short-clawed; bracts membranous, very small.......5. *Z. brevibracteatus.*

1. **Z. venenosus** Wats. Death Camas. Plants 2/3 to 2 feet high; bulb oblong-ovate, 1/3 to 1/2 (or 3/4) inch broad; leaves narrowly linear, 1 to 3 lines broad, carinate and usually folded, more or less scabrous; raceme commonly simple and narrow, 3 to 5 or 10 inches long, the bracts lanceolate, long-attenuate or even flagellate, much exceeding the buds and about as long as the pedicels; perianth segments deltoid-ovate to oblong, 1 1/2 to 2 lines long, the outer broader and with a shorter claw or sessile; gland seated above the claw furnished with a more or less evident circular ridge or thin crest, the crest on the lower side continuous with the spathe-like infolding of the basal margins of the blade; stamens about equaling the segments, somewhat adnate below; anthers white; capsule 4 to 5 (or 7) lines long.

Wet meadows: Coast Ranges, mostly near the coast; Sierra Nevada, both east and west slopes; Southern California. North to British Columbia.

Econ. Note.—This species (called "Lobelia" by the cattlemen of Modoc Co.) and Z. paniculatus are both poisonous to cattle, while the former is especially poisonous to sheep, which mistake the young leaves for grass. Probably all the species of the genus are more or less noxious. Hogs seem to be immune, whence the folk name "Hog's Potato" for Z. venenosus.

Locs.—Sonoma Co. (acc. Bot. Cal. 2:183); Jolon, Monterey Co., *Brewer* 573; Palomar, *Jepson* 1543; Tehachapi, *Heller* 7823; Lloyd Mdws., Kern River, *Jepson* 4900; Pine Ridge, Fresno Co., *Hall & Chandler* 243; Bishop, *Hall & Chandler* 7281; Yosemite Park, *Jepson*

3187 (Lake Merced), 4509 (Benson Lake), 3449 (Hetch Hetchy); Lake Eleanor, *A. L. Grant* 1254; Avery, Calaveras Co., *A. L. Grant*; Rubicon Park, Lake Tahoe, *Setchell & Dobie*; Bear Valley, Nevada Co., *Jepson*; Lake Independence, *Jepson* 8065; Willow Ranch, Warner Mts., *L. S. Smith* 940; Shasta Valley, *Butler* 1414; Indian Valley, ne. Lake Co., *Jepson* 8982; Knoxville ridge, ne. Napa Co., *Jepson* 9040.

Var. **micranthus** Jepson n. comb. Raceme more open and broader (pedicels ¾ to 1 inch long), the bracts relatively shorter; flowers usually larger, less delicate, ridge about the gland thickened, outer segments often not clawed.—North Coast Ranges and south to Contra Costa Co. This sometimes approaches Z. fremontii in habit, but the gland is more sharply defined than in that species.

Locs.—Mt. Diablo, *Chandler* 978; Tiburon, *Jepson*; Red Mt., se. Mendocino Co., *Jepson* 3030; Round Valley, *Westerman*; Sherwood Valley, *Davy* 5187; Ft. Bragg, *W. C. Mathews*; Buck Mt., *Tracy* 2779; Hubbards Sta., Humboldt Co., *Jepson* 1907.

Refs.—ZYGADENUS VENENOSUS Wats. Proc. Am. Acad. 14:279 (1879), type loc. Monterey Co.; Jepson, Fl. W. Mid. Cal. 122 (1901). Var. *ambiguus* Jones, Contrib. 12:77 (1908). *Toxicoscordion venenosum* Rybd. Bull. Torr. Club 30:272 (1903). *T. arenicola* Heller, Muhl. 2:182 (1906), type loc. foothills west of Bishop, *Heller* 8321. Var. MICRANTHUS Jepson. *Zygadenus micranthus* Eastw. Bull. Torr. Club 30:483 (1903), type loc. Cahto, Mendocino Co., *Eastwood.* *Toxicoscordion micranthum* Heller, Muhl. 6:83 (1910).

2. **Z. paniculatus** Wats. SAND-CORN. Plants 8 to 16 inches high; leaves all sheathing; main raceme with short dense supplementary racemes below; bracts ovate-lanceolate; perianth-segments deltoid-ovate, acute or acuminate, greenish thickened on the back at base, the claws very short or sometimes nearly none; gland seated above the claw, indefinitely margined, sometimes spreading nearly to the middle of the segment; stamens much exserted or at least equaling the segments; anthers yellow; capsule ½ to 1 inch long.

Sage-brush hills east of the Sierra Nevada crest from Nevada Co. to Siskiyou Co. Nevada to Washington and Montana.

Biol. Note.—The scales of the hypogaeous winter bud are very large (¾ inch broad) and conspicuous. The bulb is seated 6 to 8 inches deep and often gives rise to 2 or 3 shoots.

Locs.—Truckee, *Sonne*; Mt. Lassen, *Jepson* 4088; Little Shasta, *F. W. Hooper*; Buck Creek, Warner Mts., *L. S. Smith* 928; Fort Bidwell, *Manning.*

Refs.—ZYGADENUS PANICULATUS Wats. Bot. King 343 (1871), based on Oregon, Washington and Nevada plants; Piper, Fl. N.W. Coast 99 (1915). *Helonias paniculata* Nutt. Jour. Acad. Phila. 7:57 (1834), type loc. Flat-Head River, Mont., *Wyeth.* *Toxicoscordion paniculatum* Rydb. Bull. Torr. Bot. Club 30:272 (1903).

3. **Z. exaltatus** Eastw. Plants 2⅔ to 3½ feet high; bulb oblong-ovoid, 2 to 3 inches long; basal leaves large (¾ to 1¼ inches wide), in a conspicuous sheathing tuft; main raceme 8 to 12 inches long, with 3 to 5 supplementary racemes below, the lower bearing only staminate flowers; bracts ovate-lanceolate; perianth-segments oblong-elliptic, with claws; gland extending the length of the claw, bordered on each side by a narrow non-glandular area and terminating upon the base of the blade in a somewhat darker rounded area toothed above; stamens shorter than the perianth; anthers dull white; capsule ¾ inch long.

Sierra Nevada, from Calaveras Co. to Tulare Co., about 2000 to 4000 feet.

Locs.—Avery Sta., Calaveras Co., *A. L. Grant*; Bonita Mdw., Tulare Co., *Hall & Babcock* 5177.

Refs.—ZYGADENUS EXALTATUS Eastw. Bot. Gaz. 41:283 (1906), type loc. Mokelumne Hill, *F. E. Blaisdell.* *Toxicoscordion exaltatum* Heller, Muhl. 6:83 (1910).

4. **Z. fremontii** Wats. STAR ZYGADENE. Plants 1¼ to 2¼ feet high; bulb globose or broadly oblong, ½ to 1¼ inches broad; basal leaves 8 to 16 (or 20) inches long, 5 to 9 (or 13) lines broad, usually somewhat falcate-curving, the cauline few and shorter; main raceme with supplementary racemes below; perianth-segments ovate-lanceolate, 3 to 7 lines long, the outer broader, not clawed or shortly so, the inner contracted to a broad claw; gland greenish yellow, toothed above; stamens about half as long as the segments; capsule oblong, 6 to 10 lines long.

Deep soil on bushy hillsides: Coast Ranges, south to Southern California. Common and variable. Apr.-June.

Locs.—Rosewood, Tehama Co., *Jepson*; Round Valley, Mendocino Co., *Westerman*; Kelseyville, *H. Irwin* 30; Howell Mt., *Jepson* 546; Hood's Peak Range, *Jepson;* Kenwood, Sonoma Co., *F. T. Bioletti*; Vaca Mts., *Jepson* 2182; San Pablo Creek, *Jepson* 3004 (gland darker above the claw and bordered as in Z. venenosus); Berkeley Hills, *Tracy* 1790; Palo Alto, *C. F. Baker*; Los Gatos, *Heller* 7287; Loma Prieta, *Davy* 659; Winchester, Riverside Co., *Hall* 383.

Var. **minor** Jepson. Plants 4 to 8 inches high; raceme simple, short, broad, with few flowers.—An early form near the coast. Mar.

Locs.—Taylor Mt., Sonoma Co., *M. S. Baker* 719; San Francisco, *Jepson*; Burlingame, *Inez Smith*; Monterey, *Jepson* 2987; San Luis Obispo, *Summers.*

Var. **salsus** Jepson n. var. Very stout, ¾ to 1 foot high; basal leaves in a conspicuous sheathing tuft; glands lighter in color.—(Robustior, unc. 9–12 alta; folia basalia caespitosa vaginalia manifesta; glandulae pallidae.)—Alkaline flats, Vacaville, *Jepson* (type).

Refs.—ZYGADENUS FREMONTII Wats. Bot. King 343 (1871); Jepson, Fl. W. Mid. Cal. 122 (1901). *Anticlea fremontii* Torr. Pac. R. Rep. 4:144 (1856), type loc. Oakland Hills, *Bigelow*. *Toxicoscordion fremontii* Rydb. Bull. Torr. Club, 30:273 (1903). (*Z. speciosus* Dougl.; Hook. Fl. Bor. Am. 2:177,—1839, type from Cal., *Douglas*, is an earlier name than Anticlea fremontii but its application is uncertain.) Var. MINOR Jepson, l.c. *Z. chloranthus* var. *minor* H. & A. Bot. Beech. 402 (1841), type from Cal., *Douglas*. *Toxicoscordion fremontii* var. *minor* Gates, Jour. Linn. Soc. Bot. 44:157 (1918). Var. SALSUS Jepson.

5. **Z. brevibracteatus** Hall. Plants 15 to 22 inches high; bulb round-ovoid, 1 to 1¼ inches broad; basal leaves 6 to 8 inches long, ¼ inch broad, linear, somewhat revolute and falcate-curving; raceme loose, its pedicels ½ to 1¼ inches long, widely or horizontally divaricate; supplementary basal racemes 1 or 2, rigid, widely spreading; perianth-segments 2 to 3 lines long, distinctly short-clawed, the outer rhomboidal-ovate, the inner a little narrower; gland green, extending just above the claw, its lower margin bounded by a sharp low ridge; stamens ⅔ the length of segments; capsule 7 to 8 lines long.

Sandy mesas, western and southern borders of the Mohave Desert.

Locs.—Mt. Pinos, *Hall* 6533; Cajon Pass, *Hall* 6219; Hesperia, *Jepson* 6140; Barstow, *Jepson* 5813; Shay's Well (nw. of Warren's Well), *Jepson* 5956.

Refs.—ZYGADENUS BREVIBRACTEATUS Hall, Univ. Cal. Pub. Bot. 6:165 (1915), type loc. Cottonwood Sprs., Cottonwood Mts., *Hall* 6020. *Z. fremontii* var. *brevibracteatus* Jones. Contrib. W. Bot. 12:78 (1908), type loc. Victorville. *Toxicoscordion brevibracteatus* Gates, Jour. Linn. Soc. Bot. 44:158 (1918).

6. **VERATRUM** L. False Hellebore

Stem tall and leafy from a short thick rootstock, bearing coarse fibrous roots. Leaves broad, plaited, coarsely nerved. Stem and inflorescence pubescent. Flowers polygamous, greenish or cream-color, in a terminal panicle. Perianth of 6 distinct obovate-oblong segments, somewhat contracted at the base, adnate to the base of the ovary. Stamens 6, opposite the perianth-segments and free from them, shorter by half and recurving; filaments subulate; anthers with confluent cells, cordate. Styles 3, persistent, mostly curved. Capsule 3-celled, 3-lobed.—About 10 species, northern hemisphere. (Latin vere, truly, and ater, black, in reference to the color of the roots.)

Ovary glabrous.
  Perianth segments not fringed; capsule oblong-ovoid, ⅞ to 1¼ inches long.
    Flowers dull white; common……1. *V. californicum.*
    Flowers green; rare……2. *V. viride.*
  Perianth segments deeply fringed; capsule depressed-globose with notched apex, much-lobed laterally, 4 lines long……3. *V. fimbriatum.*
Ovary densely woolly; perianth segments erose or lightly fringed……4. *V. insolitum.*

1. **V. californicum** Durand. Corn Lily. Stem very stout and leafy, suggesting a cornstalk, 3 to 5 or 6 feet high; leaves ovate or elliptic-oblong, sheathing at base, 6 to 12 inches long or the uppermost lanceolate and shorter; panicle 1 to 1½ feet long, the lower portion often sterile; bracts mostly membranous; pedicels 1 to 4 lines long; flowers dull white, perianth-segments obovate, mostly

obtuse, 5 to 9 lines long, greenish margined at base, greenish glands at base of segments 2, or one and Y-shaped, often denticulate or erose at apex; capsule walls firm-chartaceous; seeds broadly wing-margined.

Wet flats and about springs, a characteristic plant of meadows in the Sierra Nevada at 4500 to 8500 feet; also in the North Coast Ranges and high mountains of Southern California. North to Washington, east to Colorado and south into Mexico. Often reported as poisonous to stock and sometimes called False Hellebore. July-Aug.

Locs.—North Coast Ranges: Sisson, *Jepson* 5796; Log Lake, Shackelford Creek, *Butler* 534; Trinity Summit, *Manning*; Dinsmore Ranch, Van Duzen River, *Tracy* 4280; South Yollo Bolly, *Jepson* (perianth segments oblong-lanceolate); Sherwood, *Davy*. Sierra Nevada: Mt. Bidwell, *Manning*; Bear Valley, Nevada Co., *Jepson*; Silver Lake, Amador Co., *E. Mulliken* 134; Rancheria Mt., *Jepson* 4603; Lake Merced, *Jepson* 3195; Little Kern River, *Culbertson* 4322; Hassock Mdw., Tule River, acc. *Hopping*. Southern California: Bluff Lake, San Bernardino Mts., *Pettibone*; Mt. San Jacinto, *Jepson* 2324; Palomar, *McClatchie*.

Refs.—VERATRUM CALIFORNICUM Dur. Jour. Acad. Phila. ser. 2, 3:103 (1855), type loc. near Nevada City, *Pratten*; Jepson, Fl. W. Mid. Cal. 123 (1901).

2. **V. viride** Ait. Similar to V. californicum in habit; branches of the panicle more or less drooping; principal bracts foliaceous; perianth green, about 4 lines long.

Subalpine meadows, Siskiyou Co. North to Alaska, east to New Brunswick, thence south to Georgia.

Loc.—Salmon Mts., *Butler* 536. Our only known locality in Cal.

Ref.—VERATRUM VIRIDE Ait. Hort. Kew 3:422 (1789), type from North America.

3. **V. fimbriatum** Gray. Similar in habit to the preceding; leaves linear-lanceolate, ½ to 1½ feet long, 1 to 2 or 4 inches wide; panicle ½ to 1¾ feet long, its branches widely spreading; pedicels 4 lines long; perianth-segments rhombic-ovate, 2 to 5 lines long, the margin cleft into filiform segments, except at the broad base which bears two oblong more or less glandular spots reaching to the middle of the segment and separated by a furrow; capsule walls membranous; seeds green, scarcely margined.

Vicinity of the coast, Mendocino "White Plains" or pine barrens. July.

Locs.—Ft. Bragg, *W. C. Mathews*; Albion, *Davy*.

Refs.—VERATRUM FIMBRIATUM Gray, Proc. Am. Acad. 7:391 (1868), type loc. Mendocino coast plain, *Bolander*; Jepson, Fl. W. Mid. Cal. 123 (1901).

4. **V. insolitum** Jepson n. sp. Stems 4 to 5 feet high; leaves elliptic, acute, 7 to 8 inches long, the uppermost lanceolate, 6 to 7 inches long or less; panicle 11 to 20 inches long, composed of elongated lanate-tomentose racemes; perianth-segments white, 3 to 4 lines long, obovate, mostly obtuse, irregularly ciliate or erose, or the inner segments irregularly and very shallowly fimbriate, all with 2 dark glandular spots at base; ovary densely woolly; capsule unknown.—(Folia elliptica acuta unc. 7–8 longa, summa lanceolata; panicula racemis elongatis lanato-tomentosis; segmenta perianthii lin. 3–4 longa, alba obovata impariter erosa, ciliata vel breviter fimbriata, basi maculis duabus atratis glanduliferis; ovarium tomentosissimum.)

Red-clay hills, in chaparral, Del Norte Co. Also west fork Illinois River, southern Oregon.

Locs.—Adams Sta. to Shelley Creek, *Jepson* 2915 (type); Red Hill (South Fork Smith River), *Jepson* 2900.

7. LEUCOCRINUM Nutt.

Leaves tufted on a very short rootstock, the roots cordlike. Flowers showy, pure white, fragrant, in a central cluster on the ground, the pedicels arising directly from the rootstock. Perianth persistent, salverform, its tube slender, very much elongated, its segments oblong-lanceolate. Stamens 6, inserted near the summit of the tube. Ovary ovate-oblong, seated below the ground at the base of the perianth-tube; style 1, persistent, elongated, tubular, the orifice slightly 3-lobed. Capsule triangular-obovate, loculicidal. Seeds angled, black.—Species one, western United States. (Greek leuco, white, and krinon, a lily.)

1. **L. montanum** Nutt. Sand Lily. Leaves linear, many-nerved, 3 to 5 inches long, 1½ to 2½ lines broad, the bases surrounded by scarious bracts; pedicels 2 to 6 lines long; perianth-segments oblong, 7 to 9 lines long, the tube 2 to 5 inches long.

Mountain valleys, northern Sierra Nevada, from Sierra Co. to Modoc and Siskiyou cos., 4000 to 5000 feet. Plentiful in its special localities but the localities few. Oregon and Nevada east to Nebraska.

Locs.—Adin, *M. S. Baker*; Ft. Bidwell, *Manning*.

Refs.—Leucocrinum montanum Nutt.; Gray, Ann. Lyc. N. Y. 4:110 (1837), type loc. plains of the upper Platte River, *Nuttall*; Wats. Bot. King 349, pl. 36, figs. 1 3 (1871).

8. **HESPEROCALLIS** Gray

Stem straight, simple, somewhat leafy, arising from a tunicated bulb. Leaves narrow. Flowers in a raceme, with conspicuous scarious bracts and pedicels jointed at the summit. Perianth white, withering-persistent, funnelform, 6-cleft into narrowly obovate segments. Stamens 6, inserted on the throat. Style equaling the perianth or slightly exserted; stigma disk-shaped. Capsule subglobose, loculicidal. Seeds numerous, horizontal, flattened, in 2 rows in the cells, jet black.—Species 1, deserts of Southern California and western Arizona. (Greek hesperos, western, and kallos, beauty.)

1. **H. undulata** Gray. Desert Lily. Stem 1 to 2 feet high, 4 to 18-flowered; basal leaves somewhat fleshy, carinate, wavy-margined, 1 to 2 feet long and ¼ to ¾ inch wide, the margin more or less undulate; cauline leaves few, shorter; perianth 2¼ to 2¾ inches long, its tube half as long as the segments, the segments narrowly obovate, 4 to 6 lines wide, with a broad 5 to 7-lineate bluish-green band on the back; capsule 6 to 10 lines long, abruptly tipped with the persistent style base.

Sandy valleys or rocky hills: eastern Mohave Desert and the Colorado Desert. Western Arizona. Mar.-Apr.

Locs.—Minneola, *Hall & Chandler* 6829; Ludlow, *Jepson* 5502; Needles, *Ruby Warren*; Santa Maria Mts., *Schellenger*; Carrizo Creek, *T. Brandegee*; Salt Creek, *F. Stephens*. "Often spoken of as exceedingly rare, but during my 1905 journey into the desert it was sending up its stalks, laden with beautiful flowers, from every sand-patch between Mecca and Paloverde on the Colorado Desert and between Bagdad and Newberry on the Mohave."—H. M. Hall in litt. Vallecito, *Jepson & Dutton* 8584.

Ref.—Hesperocallis undulata Gray, Proc. Am. Acad. 7:391 (1868), based on spms. from along the Colorado River (Jessup Rapids, *Newberry*, and Fort Mohave, *Cooper*).

9. **ODONTOSTOMUM** Torr.

Stem flexuous, branching, from a depressed corm. Leaves linear, mostly basal, sheathing the stem. Flowers in bracted racemes. Perianth with a narrow tube, its segments 6, soon reflexed. Stamens 6, inserted on the throat and alternating with as many short staminodia; the stamen opposite the lower outer segment stands alone and faces the remaining 5, which approximate each other on the upper side of the flower. Style 1; stigmas 3. Ovules 2 in each cell but only 1 maturing. Capsule obovate, 3-lobed, loculicidal.—Species 1. (Greek odous, tooth, and stoma, mouth, on account of the erect subulate filaments at the throat of the flower.)

1. **O. hartwegii** Torr. Erect, 5 to 10 inches high; basal leaves 3 to 9 inches long, 2 to 5 lines wide, with caudate-attenuate apex; racemes 2 to 5 inches long; bracts and bractlets subulate; perianth-tube 2 to 3 lines long, the reflexed segments as long or a little longer, narrowly oblong, 5 or 6-nerved.

Dry hard soil: Sierra Nevada foothills from Mariposa Co. to Butte Co.; local in the foothills of the middle and inner North Coast Ranges (Napa Co. and Tehama Co.); 400 to 1300 feet. May.

Locs.—St. Helena, *Jepson*; Manzanita Flat, Dibble Creek, w. Tehama Co., *Jepson*; Redding, *Heller* 7846; near Chico, *R. M. Austin*; Auburn, *Sonne*; Rose Sprs., Placer Co., *M. H. Gates*; Angels Camp, *Davy*; Chinese Camp, *Jepson* 6312; Agua Fria Cañon, Mariposa Co., *Congdon*.

Refs.—ODONTOSTOMUM HARTWEGII Torr. Pac. R. Rep. 4:150, pl. 24 (1857), type loc. Ione Valley, *Bigelow*; Jepson, Erythea, 2:157 (1894), Fl. W. Mid. Cal. 114 (1901).

10. **SCHOENOLIRION** Torr.

Stem simple, scapose, this and the linear-elongated leaves from a tunicated bulb. Raceme elongated, densely many-flowered, with 1 or 2 short supplementary racemes below. Flowers on very short pedicels jointed at the summit. Perianth white, becoming scarious, persistent; segments 6, distinct, oblong, 3-nerved. Stamens 6, adnate to the base of the perianth-segments. Ovary ovate, short-stipitate, the cells 2-ovuled. Style persistent; stigma 3-cleft. Capsule loculicidal; seeds black.—Species 5, North America. (Greek schoinos, a rush, and lirion, a lily.)

Outer bulb-coat fibrous; perianth-segments linear-oblong..........1. *S. album.*
Outer bulb-coat membranous; perianth-segments lanceolate..........2. *S. bracteosum.*

1. **S. album** Dur. Scape ¾ to 5 feet high; leaves flat, 1½ to 2 feet long, 2 to 6 lines wide; perianth white, tinged or tipped with green, pink or lilac, its segments linear-oblong, obtuse, 2½ to 3 lines long; stamens about equaling the perianth; ovary slightly 6-lobed; style slightly 3-cleft; capsule globose-ovate, 3 lines long.

Mountain swamps, northern Sierra Nevada from Plumas Co. to Mt. Shasta, thence southwest to Mendocino Co.; 3500 to 7000 feet. Southern Oregon. Apr.-July.

Locs.—Red Mt., n. Mendocino Co., *Bolander* 6559; Trinity Summit, *Davy* 5855; Forks of Salmon, *Jepson* 2082; Red Hill, Del Norte Co., *Jepson* 2902 (petals soon reflexed and the membranous margins involute along the green midvein; perhaps a distinct form); Quartz Valley, w. Siskiyou Co., *Butler* 790; Mt. Eddy, *Copeland* 3864; Sisson, *Jepson* 5789; Dead Horse Cañon, e. Siskiyou Co., *M. S. Baker*; Bear Valley Mts., Shasta Co., *M. S. Baker* 562; Colby, Butte Co., *R. M. Austin* 739; Snake Lake Valley, Plumas Co., *Hall* 9300.

Refs.—SCHOENOLIRION ALBUM Dur. Jour. Phila. ser. 2, 3:103 (1855), type loc. Nevada City, *Pratten*. *Hastingsia alba* Wats. Proc. Am. Acad. 14:242 (1879).

2. **S. bracteosum** Jepson n. comb. Habit similar to S. album; perianth segments dull white, lanceolate, acuminate, 4 to 5 lines long, the stamens about half as long.

Bogs and stream banks, north boundary of Del Norte Co. and adjacent Oregon. Too little known to us.

Loc.—Highest Siskiyou Mts., Waldo-Crescent City road, *Cusick* 2912.

Refs.—SCHOENOLIRION BRACTEOSUM Jepson. *Hastingsia bracteosa* Wats. Proc. Am. Acad. 20:377 (1885), type loc. Eight Dollar Mt., Curry Co., Ore., *Howell*.

11. **CAMASSIA** Lindl.

Stem slender, scapose, arising from a tunicated bulb, the linear leaves basal. Flowers dark blue or nearly white, in a simple raceme. Bracts scarious. Pedicels jointed at the summit. Perianth-segments 6, distinct, oblanceolate, nerved, somewhat spreading. Stamens 6, on the base of the perianth, shorter than the segments. Style filiform, slightly 3-cleft at apex, the lower part persistent. Capsule 3-lobed, loculicidally 3-valved. Seeds several in each cell.—Species 3, North America. (Quamash or camass, the name of the northwest Indians.)

Bibliog.—Coville, F. V., Technical Name of the Camas Plant (Proc. Biol. Soc. Wash. 11:61-65,—1897). Piper, C. V., Notes on Quamasia (Proc. Biol. Soc. Wash. 29:77-82,—1916).

Perianth-segments 3 or sometimes 5-nerved; buds gibbous on one side..........1. *C. quamash.*
Perianth-segments usually 5 (or 7 to 9)-nerved; buds not gibbous..........2. *C. leichtlinii.*

1. **C. quamash** Greene. CAMASS. Scape stoutish, 1 to 2½ feet high; raceme 5 to 25-flowered; flowers dark blue, rarely white; perianth-segments unequal, spreading unequally in 2 sets of 3 each, nearly 6 to 10 lines long, each twisted separately after blooming; capsule obtusely angled, its valves pinnately veined.

Wet meadows or wet bottoms, Sierra Nevada, 4500 to 6500 feet; high North Coast Ranges. North to British Columbia and east to Utah.

Locs.—Round Mdw., Giant Forest, *Jepson* 672; Pine Ridge, Fresno Co., *Hall & Chandler* (perianth-segments twisting over ovary); Little Yosemite, *Hall* 9047; Rancheria Mt., Yosemite Park, *Jepson* 4604; Truckee, *Sonne*; Modoc Co., *M. S. Baker*; Mt. Hull, *Hall* 9546a (twisting perianth!).

Refs.—CAMASSIA QUAMASH Greene, Man. Bay Reg. 313 (1894). *Phalangium quamash* Pursh, Fl. 1:226 (1814), type loc. Weippe, Ida., *Lewis*. *Quamasia quamash* Cov. Proc. Biol. Soc. Wash. 11:64 (1897). *Camassia esculenta* Lindl. Bot. Reg. t. 1486 (1832).

2. **C. leichtlinii** Wats. Similar to C. quamash; flowers dark blue to cream color; perianth-segments 10 to 12 lines long, spreading regularly in a perfect star, withering and twisting over the capsule like a bon-bon, at length deciduous as a whole; capsule oblong-obovate, slightly notched at apex, its valves closely veined horizontally.

Wet flats or grassy plains; Marin and Napa cos. to Humboldt Co., and easterly to Sierra Co. North to British Columbia.

Locs.—Inverness, *Jepson* 8302 (perianth-segments withering separately); Napa Valley, *Clara Hunt*; Red Mt., se. of Ukiah, *Jepson* 3035; Ft. Bragg, *W. C. Mathews*; Willow Creek, Trinity River, *Tracy* 3388; Sierra Valley, *Alma Ames*.

Refs.—CAMASSIA LEICHTLINII Wats. Proc. Am. Acad. 20:376 (1885). *Chlorogalum leichtlinii* Baker, Gard. Chron. ser. 2, 1:689 (1874), type collected by Jeffrey, probably in the Umpqua Valley, Ore., and not in "British Columbia," acc. Piper. *Camassia esculenta* var. *leichtlinii* Baker, Bot. Mag. t. 6287 (1877).

12. CHLOROGALUM Kunth.

Stem from a tunicated bulb, often tall, almost leafless, ending in a panicle of racemose branches. Leaves of the basal tuft long-linear. Bracts small and scarious. Pedicels jointed at the summit. Perianth white, purple or pinkish, persistent and at length twisted over the ovary; segments 6, distinct, spreading, ribbon-like, with 3 distinct but closely approximate nerves down the middle. Stamens 6, rather shorter than the segments and inserted on their bases. Style long-filiform, slightly 3-cleft at apex. Capsule broadly turbinate, 3-lobed, loculicidal, with 1 or 2 seeds in each cell.—Species 4, California and adjacent borders north and south. (Greek chloros, green, and gala, milk or juice.)

Perianth-segments rotate-spreading, 8 to 10 lines long; bulb with a heavy coat of coarse fibers; leaves ½ to 1½ inches broad; pedicels 3 lines long or more..............1. *C. pomeridianum.*

Perianth-segments somewhat spreading from above the base, 3 to 5 lines long; bulb with a membranous coat; leaves ¼ inch wide or less.

  Pedicels shorter than the perianth; flowers white or pinkish.

    Flowers white with yellowish-green lines; style included; ovary on a short stipe................ 2. *C. angustifolium.*

    Flowers white with rose-colored midnerve or pinkish; style exserted as ovary matures; ovary sessile..............................3. *C. parviflorum.*

  Pedicels as long or longer than the perianth; flowers blue or purplish; ovary sessile.......... 4. *C. purpureum.*

1. **C. pomeridianum** Kunth. SOAP PLANT. Plants 2 to 10 feet high, with ample spreading panicle; bulb 3 to 4 inches long and 1½ to 2 inches thick with a very dense coat of coarse brown fibres; basal leaves numerous, ¾ to 2½ feet long, ½ to 1½ inches broad, carinate, strongly undulate; pedicels slender, about 3 to 6 lines long; perianth-segments linear, 8 to 10 lines long, white, purple-veined, spreading widely; capsule 3 lines long, the valves pinnately nerved.

Dry open low hills and plains, Sierra Nevada foothills, Great Valley, Coast Ranges, south to cismontane Southern California, and north to southern Oregon.

Absent from the Colorado and Mohave deserts and the arid region east of the Sierra Nevada, and the Redwood belt. July-Aug.

Locs.—Bear Valley, Nevada Co., *Jepson*; Gwin Mine, Calaveras Co., *Jepson*; Hetch-Hetchy, *Jepson*; North Fork Kaweah River, *Jepson*; Hupa Valley, *P. E. Goddard*; Mt. Konocti, Lake Co., *Jepson*; Mt. Tamalpais, *E. Mulliken* 72; Little Oak, Solano Co., *Jepson*; Coyote Creek, Santa Clara Co., *Jepson*; San Luis Obispo, *Summers* 825; Lower Rubio Cañon, *Peirson* 10; San Bernardino, *Parish*.

Refs.—CHLOROGALUM POMERIDIANUM Kunth. Enum. Pl. 4:682 (1843); Torr. Bot. Mex. Bound. 218, pl. 60 (1859); Wats. Bot. Cal. 2:159 (1880); Jepson, Fl. W. Mid. Cal. 121 (1901). *Anthericum pomeridianum* Ker. Bot. Reg. t. 564 (1821), type not given. *Laothoe pomeridiana* Raf. Fl. Tellur. 3:53 (1836).

2. **C. angustifolium** Kell. Plants 1½ to 2 feet high; bulb-coats membranous, light reddish-brown; basal leaves 4 to 12 inches long, 1 to 2 or 3 lines broad, becoming revolute; panicle with few ascending branches; pedicels about 2 lines long; perianth funnelform-campanulate, the segments oblong-linear, 4 to 5 lines long, white with yellowish-green veins; ovary on a short stipe.

Lower foothills of the Sierra Nevada, Calaveras Co. north to Shasta Co., thence south in the inner Coast Range to Mendocino Co.

Locs.—Milton, *Davy* 1229; Ione, *Braunton* 1005; Blue Ravine, Eldorado Co., *K. Brandegee*; Redding, *Hall & Babcock* 4003; Round Valley (Zoe, 4:159).

Refs.—CHLOROGALUM ANGUSTIFOLIUM Kell. Proc. Cal. Acad. 2:104, fig. 30 (1863), type loc. Shasta, *Veatch*; Wats. Bot. Cal. 2:160 (1880); Jepson, Fl. W. Mid. Cal. 121 (1901). *Laothoe angustifolia* Greene, Leafl. 1:91 (1904).

3. **C. parviflorum** Wats. Plants 1 to 2 feet high; bulb 1 inch in diameter; basal leaves grass-like (2 to 3 lines broad); pedicels short, 1 or rarely 2 lines long; flowers pinkish or white with rose-colored midnerve; perianth-segments oblong-lanceolate, spreading from above the base, 3 or sometimes 4 lines long; style exserted as ovary matures; ovary broad and obtuse, sessile.

Cismontane Southern California in Riverside and San Diego cos., from the coast inland 24 to 35 miles.

Locs.—Menifee, Riverside Co., *E. Foster*; Oceanside, *Parish* 4444; San Diego, *Jepson* 1600; Alpine, *T. Brandegee*.

Refs.—CHLOROGALUM PARVIFLORUM Wats. Proc. Am. Acad. 14:243 (1879), type loc. El Cajon Valley, San Diego Co., *D. Cleveland*. *Laothoe parviflora* Greene, Leafl. 1:91 (1904).

4. **C. purpureum** Brandegee. Plants 14 to 20 inches high; bulbs light-colored, ovoid, ¾ to 1 inch in diameter; basal leaves narrowly linear, 1 to 2 lines wide, undulate; pedicels as long or longer than the (3 lines long) perianth; perianth-segments spreading from above the base, oblong-ovate, blue or purplish with 3 darker midveins; stamens about equaling the segments; style sometimes slightly exserted in old flowers; ovary sessile.

Western Monterey Co. June.

Locs.—Jolon, *Hall* 10019; Milpitas Ranch, *Eastwood*.

Refs.—CHLOROGALUM PURPUREUM Brandegee, Zoe 4:159 (1893), type loc. Santa Lucia Mts., *W. Vortriede*. *Laothoe purpurea* Greene, Leafl. 1:91 (1904).

13. **ALLIUM** L. WILD ONION

Stem scapose, from a tunicated or sometimes rhizome-like bulb or from a corm, with basal leaves, and bearing an umbel or head of flowers subtended by 2 or 3 thin whitish or scarious bracts. Herbage with the characteristic taste and odor of onions. Leaves narrow and plane, or convolute-filiform or terete. Perianth of 6 distinct or nearly distinct equal 1-nerved segments, campanulate or spreading. Stamens inserted on the base of the segments; filaments often dilated below. Ovules 2 (rarely several) in each cell; style filiform, persistent; stigma simple or 3-parted. Capsule obovate or globose, obtusely 3-lobed, often crested; seeds 1 or 2 in each cell, black, wrinkled.—Species 250, north temperate zone. (Ancient Latin name of garlic.)

A. Scape terete; leaves 1 to several, linear, filiform or terete.

1. *Plants with rootstocks and bulbs.*

Rootstock crowned by the bulb, more or less persistent; bulb narrowly oblong or elongated ovoid, heavily sheathed with the bases of several leaves.

Scapes 1½ to 3 feet high; bulbs white or light-colored, narrowly oblong, ½ to 1¼ inches broad ......1. *A. validum.*

Scapes 8 to 12 inches high; bulbs generally deep red, elongated ovoid, ½ to ¾ inch broad. 2. *A. haematochiton.*

Rootstock slender, horizontal, bearing terminally one or few corms and giving rise to an erect scape; corm short-ovoid or round ......3. *A. unifolium.*

2. *Plants without rootstocks; bulb ovoid or globose; leaves deciduous above outer bulb-coats.*

Bulb-coats with indistinct reticulation or none.

Leaves terete or sub-terete, solid; ovary crests conspicuous.

Scapes 12 to 20 inches high; bulbs pinkish; leaves 1 or 2 ......4. *A. intactum.*

Scapes 2 to 8 inches high; bulbs reddish-brown; leaf solitary.

Leaves not coiled at tip; Southern California.

Perianth-segments lanceolate-attenuate; ovary crests emarginate ......5. *A. parryi.*

Perianth-segments ovate-lanceolate; ovary crests more or less fimbriate.

Scapes mostly slender; perianth-segments 3 to 5 lines long, usually recurved at tip, sometimes spreading; mostly of the desert slopes ......6. *A. fimbriatum.*

Scapes stout; perianth-segments closely erect, straight at tip, 6 to 7 lines long; high San Gabriel Mts ......7. *A. peirsonii.*

Leaves coiled at tip; east side of the Sierra Nevada ......8. *A. atrorubens.*

Leaves plane.

Scapes 4 to 15 inches high; ovary crests conspicuous; perianth-segments broadly ovate to lanceolate.

Flowers 5 to 6 lines long; ovary crests twice as long as the ovary ......9. *A. anserinum.*

Flowers 3 to 4 lines long; ovary crests shorter than the ovary.

Perianth-segments acuminate, rose-color.

Scapes solitary ......10. *A. campanulatum.*

Scapes commonly in pairs ......11. *A. bisceptrum.*

Perianth-segments acute, pinkish to white ......12. *A. sanbornii.*

Scapes ¼ to 2½ inches high; ovary crests evident to obscure; perianth-segments lanceolate to oblong, obtuse to acuminate.

Stamens shorter than the perianth; Sierra Nevada ......13. *A. tribracteatum.*

Stamens equaling or exceeding the perianth; Southern California ......14. *A. burlewii.*

Bulb-coats with distinct reticulation.

Reticulation of bulb-coats undulate-horizontal.

Leaves 2; bulbs gray; ovary without crests ......15. *A. hyalinum.*

Leaves several; bulbs deep red; ovary broadly crested ......16. *A. amplectens.*

Reticulation of bulb-coats close, strongly serrate-horizontal.

Ovary crests minute, central.

Outer perianth-segments only slightly wider than the inner.

Perianth commonly pink; pedicels equal, ¼ to ½ inch long; interior ......17. *A. serratum.*

Perianth rose-purple; pedicels unequal, ¼ to ¾ inch long; maritime ......18. *A. dichlamydeum.*

Outer perianth-segments twice as wide as the inner and slightly longer; perianth rose-purple; pedicels unequal, ¾ to 1¼ inches long ......19. *A. peninsulare.*

Ovary crests broad, rounded; perianth-segments glandular-denticulate 20. *A. bolanderi.*

Reticulation of bulb-coats coarse quadrate to hexagonal.

Perianth-segments deep rose-color, acuminate, the margins undulate-serrulate; pedicels ½ to 1 inch long ......21. *A. acuminatum.*

Perianth-segments pinkish to rose-color, acute, the margins entire; pedicels ¼ to ½ inch long ......22. *A. lacunosum.*

B. Scape much flattened and 2-edged or narrowly winged; leaves usually 2, broadly linear or falcate.

Perianth-segments narrowly lanceolate, long acuminate, or becoming filiform-subulate; stamens nearly equaling segments or exserted; ovary not crested; bulb-coats without reticulation; northern Sierra Nevada ......23. *A. platycaule.*

Perianth segments ovate-lanceolate, acute to acuminate; stamens ½ to ¾ as long as, or sometimes equaling, the segments.
  Ovary crests consisting of a curved ridge; bulb-coats mostly with faint reticulation; northern Sierra Nevada.
    Filaments dilated at base but distinct..24. *A. anceps.*
    Filaments united by thin dilated bases into a sort of cup........................25. *A. modocense.*
  Ovary with ridges of the lobes produced above into prominent crests; filaments distinct; bulb coats not reticulated; Coast Ranges.
    Umbels loose (pedicels 6 to 13 lines long)..26. *A. falcifolium.*
    Umbels more compact (pedicels 4 to 7 lines long)..27. *A. breweri.*

1. **A. validum** Wats. SWAMP ONION. Scape stout, 2-edged above, 3 to 6 lines in diameter, 1½ to 3 (or 3½) feet high; bulb ½ to 1¼ inches thick and 1½ to 2 times as long, crowning a very stout rootstock; roots thick and coarse; bulb-coats white to light reddish-brown, prominently ribbed, continuous with the broad leaves, these 4 to 6 lines wide, 1 to 2 (or 3) feet long; perianth-segments 3 to 6 lines long, lanceolate-acuminate, rose-color to nearly white; stamens and style usually exserted; capsule large, subglobose, not crested.

Wet meadows, Sierra Nevada north to Siskiyou Co., thence southerly to Trinity Co.; 4000 to 9000 feet. Common. Also in Oregon.

Locs.—Garfield Forest, Sequoia Park, *Jepson* 4661; Farewell Gap, *Jepson* 1145; Lake Merced, Yosemite Park, *Jepson* 3214; Kennedy Mdws., *A. L. Grant* 178; Silver Lake, Amador Co., *Mulliken* 139; Suzy Lake, El Dorado Co., *Jepson* 8184; Donner Lake, *Sonne*; Warner Mts., *L. S. Smith* 1131; Cedar Spr., Mt. Shasta, *Jepson*; Shackelford Creek, w. Siskiyou Co., *Butler* 112; Twin Lakes, Trinity Co., *Eastwood.*

Ref.—ALLIUM VALIDUM Wats. Bot. King, 350 (1871), type loc. Mono Pass, *Bolander* 6248.

2. **A. haematochiton** Wats. Scape stout, flexuous, 7 to 12 inches high; bulb elongated-ovoid, ½ to ¾ inch broad, its coats usually deep red, rarely pale pink; leaves many, abruptly narrowing or filiform above the broad sheaths; pedicels numerous, ¼ to 1 inch long; perianth-segments deep rose-color (or often nearly white) with darker midnerve, broadly ovate-acute, 3 to 4 lines long; filaments ⅔ as long as the perianth-segments, narrowly subulate, with adnate deltoid bases; ovary white, truncate with very short rounded or undulate dark red crests.

Dry hills and mountain slopes from San Luis Obispo Co. to San Diego Co.

Locs.—San Luis Obispo, *Summers;* Lockwood Valley, Mt. Pinos, *Hall* 6333; Banning, *R. J. Smith* 300; Strawberry Valley, San Jacinto Mts., *Hall* 2096; Palomar, *Jepson* 1487; La Mesa, San Diego Co., *Jepson* 6679.

Refs.—ALLIUM HAEMATOCHITON Wats. Proc. Am. Acad. 14:227 (1879), type loc. San Luis Obispo, *Brewer* 462; Abrams, Fl. Los Ang. 84 (1904).

3. **A. unifolium** Kell. Scape stout, 1 to 2 feet high, rising from a deeply seated short horizontal rootstock bearing one or a few corms, only the rootstock or base of scape rooting; reticulation of corm coats irregular to vertical undulate; leaves 4 or 3; bracts 2, large, acuminate, membranous; umbels 10 to 30-flowered, the pedicels 1 to 1½ inches long; flowers lavender-pink; segments broadly oblong-ovate, 5 to 7 lines long, ⅓ longer than the stamens and style; ovary not crested, but with quadratish lobes.

Rich moist lands in the valleys or open hills; Coast Ranges, 20 to 400 feet, from Monterey Co. north to Humboldt Co. Local.

Biol. Note.—The stem arises from a corm which through exhaustion becomes a rootstock as is evidenced by the husk of the former corm which for a time surrounds it. The rootstock sends out two prongs in opposite directions or nearly, each developing a corm. Apparently these new corms become independent the next season, each sends up a stem, and at the same time develops two new corms as the parent corm becomes depleted.

Locs.—Pacific Grove, *Heller* 6845; Mt. Diablo, *Jepson* 7588; Berkeley and Mt. Tamalpais, acc. Behr; Conn Valley, Napa Co., *Jepson*; Ft. Bragg, *W. C. Mathews* 51; White Thorn Valley, Mattole River, *Tracy* 5004; Eureka, *Tracy* 4078.

Refs.—ALLIUM UNIFOLIUM Kell. Proc. Cal. Acad. 2:112, f. 35 (1863), type loc. Oakland; Wats. Bot. King, 486, pl. 36, figs. 9–10 (1871); Baker, Bot. Mag. t. 6320, figs. 1–4 (1877); Behr, Fl. Vic. S. F. 287 (1888); Jepson, Fl. W. Mid. Cal. 119 (1901). Var. LACTEUM Greene, Pitt. 2:55 (1890), type loc. San Luis Obispo Co., *Lemmon.* Stouter and more succulent; perianth white.—Ex. char.

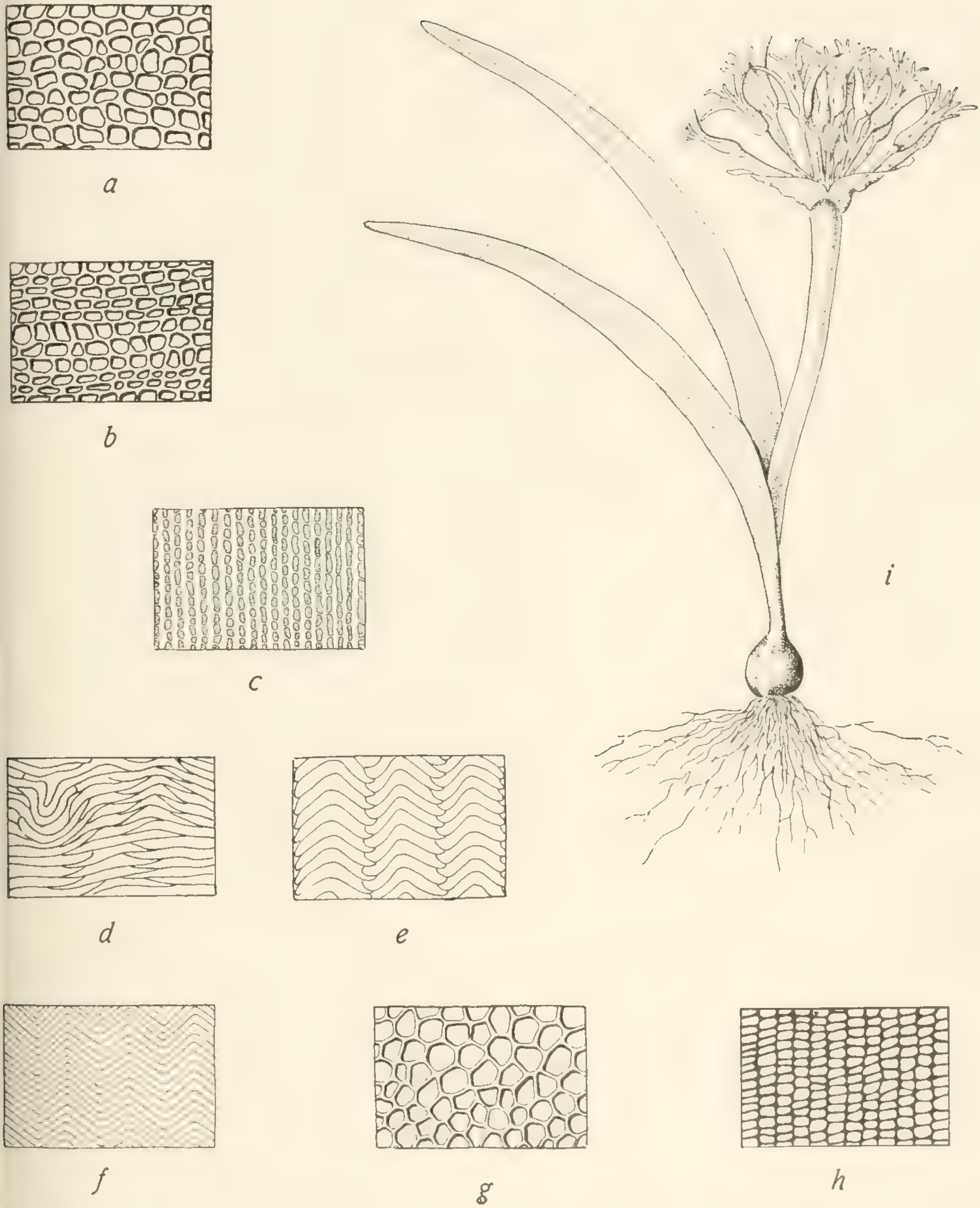

Fig. 47. Bulb coat reticulations in Allium: *a*, A. PARRYI Wats., × 20. *b*, A. FIMBRIATUM Wats., × 20. *c*, A. SANBORNII Wood, × 10. *d*, A. HYALINUM Curran var. PRAECOX Jepson, × 10. *e*, A. PENINSULARE Lemmon, × 10. *f*, A. BOLANDERI Wats., × 10. *g*, A. ACUMINATUM Hook., × 5. *h*, A. LACUNOSUM Wats., × 10. *i*, habit of A. FALCIFOLIUM H. & A., × ½.

4. **A. intactum** Jepson n. sp. Scape 12 to 20 inches high, stiff, slightly flexuous or erect; bulb-coats numerous, pinkish, the reticulation vertical, minutely rectangular; leaves 1 or 2, terete, solid, sheathing the stem 3 to 6 inches, the sheath entire (not split down); bracts 3, large, ovate-acuminate with attenuate tips; umbels round, densely flowered; pedicels slender, ½ to ¾ inch long; perianth-segments pink to rose-color with deeper midnerve, rather thin, lanceolate-acuminate, erose, 2 lines long; stamens equaling or exceeding the perianth; filaments opposite the inner segments with long narrow triangular bases adnate to the petal for almost half their length, the alternate filaments with short deltoid bases; style exserted, stigmas 3-parted; ovary with very thin walls and 6 conspicuous thin crests; crests as long as the ovary; capsule one-seeded.—(Scapus rigidus, leviter flexuosus vel erectus, unc. 12-20 altus; reticulum tunicae bulbi minute rectangulare ad perpendiculum directum; folia 1-2, teretia, non cava; stamina perianthio aequantia vel hoc superantia; cristae ovarii 6 conspicuae tenues aequantes ovario; capsula monosperma.)

Placer Co. (Cape Horn, *K. Brandegee*, type); not otherwise known.

5. **A. parryi** Wats. (Fig. 47a.) Scape 3 to 6 inches high; bulb coats reddish brown, quadratish-reticulate; leaf solitary, as long as or slightly longer than the scape, the sheath entire, about ½ as long as the scape; pedicels 4 to 8 lines long; perianth-segments lanceolate, acuminate, erect, 3 to 4 lines long, white to pale rose; stamens opposite the outer segments about ¾ their length; ovary crests conspicuous, emarginate to erose.

San Bernardino Mts., 6500 feet.

Locs.—Bear Valley, *Parish* 3761, 3078. The genuine form has been collected only in the San Bernardino Mts., but the variants of A. fimbriatum simulate it very closely in a continuous series.

Ref.—ALLIUM PARRYI Wats. Proc. Am. Acad. 14:231 (1879), type loc. San Bernardino Co., *Parry* 390 (specifically in Big Bear Valley acc. to Parish).

6. **A. fimbriatum** Wats. (Fig. 47b.) Scape 2 to 3 inches high, the leaves terete, narrow (½ to 1 line broad), exceeding the scape; sheaths entire; pedicels 2 to 6 lines long; bracts 2, sometimes 3 or 4; perianth dark to pale rose, its segments ovate-lanceolate, 4 to 5 (or 6) lines long, erect but the tips more or less recurving; stamens ½ as long as the segments; ovary crests 2 to each lobe, finely toothed or fimbriate to nearly entire.

Ranges bordering the desert from San Diego Co. north through the Mohave Desert.

Locs.—Mt. Pinos, *Hall* 6557; Mt. Soledad, *Johnston* 2251; Providence Mts., *Munz, Johnston & Harwood* 4218; Ord Mt., *Jepson* 5879; Vandeventer, San Jacinto Mts., *Jepson* 1461; Blair Valley, e. San Diego Co., *Jepson* 8693; Vallecito, *Jepson* 8537; Jacumba, *T. Brandegee*.

Var. **mohavense** Jepson n. var. Perianth-segments ovate, bluntish or rounded, 3 lines long, commonly pale pink; ovary crests sparingly toothed or emarginate.—(Segmentis perianthium late ovatis obtusis, erectis, apice non recurvatis, lin. 3 longis; cristis ovarium subintegris.)—Eastern Mohave Desert (Calico Mts., *Jepson* 5403, type.)

Var. **aboriginum** Jepson n. var. Umbels relatively loose, the pedicels 8 to 10 lines long; ovary crests long and thin, toothed.—(Umbella sublaxa, pediculi lin. 8-10 longi; cristis ovarium longis tenuibus dentatis.)—Southern Sierra Nevada from Fresno Co. to Tulare Co., and inner North Coast Range.

Locs.—Pine Ridge, Fresno Co., *Hall & Chandler* 201; Erskin Creek, *Purpus* 5332; Walker's Basin, *T. Brandegee*; Indian Valley, ne. Lake Co., *Jepson* 8995 (type).

Refs.—ALLIUM FIMBRIATUM Wats. Proc. Am. Acad. 14:232 (1879), type loc. Mohave River, Palmer. *A. parishii* Wats. l.c. 17:380 (1882), type loc. Cushenberry Sprs., *Parish*. Var. MOHAVENSE Jepson. Var. ABORIGINUM Jepson.

A. DAVISIAE Jones, Contrib. 12:78 (1908), type loc. granite rocks, Victorville, Mohave Desert, is probably close to A. fimbriatum var. mohavense; it has 2 bracts; perianth-segments oval, acute, rather rigid, white, green ribbed, ½ longer than the stamens; but the ovary is not crested (ex. char.).

A. DECIPIENS Jones, Contrib. 10:16 (1902); *A. inyoensis* Jones l.c. 10:86, type loc. "Summit, Owens Valley, 7000 ft.," seems near A. fimbriatum, but we have seen no specimens.

7. **A. peirsonii** Jepson n. sp. Scape stout, 3 to 4 inches high; leaf 1, terete or teretish, 1 to 2½ lines thick, 4 to 8½ inches long above the sheath (much exceeding the scape); flowers many in a compact umbel, the pedicels 3 to 4 (or 5) lines long; bracts 2; perianth reddish or light pink, 6 to 7 lines long, the segments straight, stamens about ¾ the length of the perianth-segments; ovary crests prominent, slender, often as long as the ovary, toothed at apex.—(Scapus robustus, unc. 3-4 altus; folium singulare, teres vel subteres, lin. 1-2½ diametro, lin. 4-8½ longum; umbella compacta, multiflora; perianthium lin. 6-7 longum, segmentis rectis; cristis ovarium conspicuis gracilibus, apice dentatis saepe aeque longis ac ovarium.)

Rock slides, high cañons of the San Gabriel Mts., 5350 to 9400 feet.

Locs.—Mt. San Antonio, *Peirson* 3 (type); San Antonio Cañon (head), *Johnston* 1446; Rock Creek (head), *Peirson* 267; divide betw. Mt. Lowe and Mt. Markham, *Peirson* 1.

8. **A. atrorubens** Wats. Three to 4 inches high; bulb-coats without distinct reticulation; pedicels 15 to 20, 6 to 7 lines long; bracts 2 or 3; leaves coiled at tip; flowers dark or lead-purple; perianth-segments stiff, long-acuminate, 4 to 5 lines long.

East side of the Sierra Nevada.

Locs.—Reno, Nev., *Cowgill*. Owens Valley, Cal., acc. Jones (Contrib. 10:16), who says the corms produce runners with brilliant shiny bulblets strung along them.

Ref.—ALLIUM ATRORUBENS Wats. Bot. King, 352, pl. 38, figs. 4–5 (1871), type loc. west Humboldt to the Havallah Mountains, Nev.

9. **A. anserinum** Jepson n. sp. Scape terete, 5 to 6 inches high; leaf one, flat; umbel about 20-flowered; pedicels about 4 lines long; perianth purplish or pinkish, its segments oblong-ovate, 5 to 6 lines long, spreading at tip; stamens about ⅔ as long as the perianth; ovary-cells with 2 crests; crests oblongish, much lacerate or laciniate, twice as long as the ovary; stigma slightly 3-cleft.—(Scapus teres, unc. 5-6 altus; folium singulare planum; ovarium 2-cristatis lobis; cristae suboblongae, multum laceratae, duplo longiores ovario.)

Modoc Co.

Loc.—Goose Lake Valley, *R. M. Austin* (type).

10. **A. campanulatum** Wats. Scape 4 to 7 or 11 inches high, erect, often flexuous; leaves 2; umbel 10 to 50-flowered; pedicels 4 to 15 lines long; flowers somewhat campanulate, pink or rose-color; perianth-segments broadly ovate, acute or short-acuminate, 3 to 4 lines long, nearly equal, ¼ longer than the very slender stamens and style; filament bases nearly equal; ovary prominently crested, the crests somewhat horizontal.

Usually in dry places, Sierra Nevada, south to Tehachapi, north to Shasta Co., thence southerly to eastern Humboldt Co., 3000 to 6000 feet. Passing into var. bidwelliae at the higher altitudes. The accumulation of material has also tended to weaken the distinctions betwen A. campanulatum and A. bisceptrum but we continue to retain the two as species.

Locs.—Tehachapi, *Greene*; Marble Fork, Sequoia Park, *Jepson* 648; Huntington Lake, Fresno Co., *A. L. Grant* 1045; Volcano Creek, Tulare Co., *Jepson* 4928a; Hazel Green, *Hall & Babcock* 3403a; Sonora Pass, *A. L. Grant*; South Fork Bear Creek, Shasta Co., *Hall & Babcock* 4145; Buck Mt., Humboldt Co., *Tracy* 2836.

Var. **bidwelliae** Jepson n. comb. Perianth-segments ovate at base, long-acuminate above.—Sierra Nevada and inner North Coast Range, 6000 to 9000 feet. Western Nevada to Oregon.

Locs.—Horse Mdw., Tulare Co., *Hall & Babcock* 5136; Benson Lake, Yosemite Park, *Jepson* 4518; Belle Mdw., Tuolumne Co., *Jepson* 6470; Lake Lucile, Eldorado Co., *Hall & Chandler* 4667; Hot Springs Valley, Plumas Co., *Jepson* 4077; Mt. Hull, Lake Co., *Hall* 9536.

Refs.—ALLIUM CAMPANULATUM Wats. Proc. Am. Acad. 14:231 (1879), based on Mt. Bullion, Mariposa Co., *Bolander* 4943, and Plumas Co., *M. E. P. Ames*; Hall, Univ. Cal. Publ. Bot. 4:196 (1912). Var. BIDWELLIAE Jepson. *A. bidwelliae* Wats. l.c., type loc. "above Chico," *Annie Bidwell*. *A. austinae* Jones, Contrib. 10:85 (1902), found at Summit and Castle Peak, crests very prominent, spreading from the summit of the ovary "like a rotate corolla."—Ex. char.

11. **A. bisceptrum** Wats. Scapes often stout, commonly in pairs (or 3s or 4s), but frequently solitary, 5 or 10 to 14 inches high; bulb-coats light-colored with indistinct reticulation; flowers few to many, rose-colored; perianth-segments 3 to 4 lines long, unequal, oblong-lanceolate, acuminate, exceeding the stamens, the inner more narrow, their bases hidden by the broad outer ones; filaments with unequal deltoid bases, those opposite the inner perianth-segments with bases expanded and adnate, the alternate ones with mainly free bases; ovary crests 2 or 3 to each lobe, very thin, conspicuous, sometimes much toothed.

East of the Sierra Nevada crest (from Tulare Co. to Placer Co. and north to Modoc Co.), also local on the west slope, and very local in the high inner Coast Ranges; San Bernardino Mts. Also in Nevada.

Locs.—Alta Mdws., Tulare Co., *K. Brandegee*; Hazel Green, *Jepson*; Merced Big Trees, *Jepson*; Andrews Camp, Inyo Co., *K. Brandegee*; Walker Lake, Mono Co., *Jepson* 4448; Kennedy Lake, Tuolumne Co., *A. L. Grant* 256; mts. of e. Placer Co., *Sonne*; New Pine Creek, Warner Mts., *L. S. Smith*; South Yolo Bolly, *Jepson*; Frazier Mt., Ventura Co., *Hall* 6607; San Bernardino Mts., acc. *Parish* (Pl. World, 20:208).

Refs.—ALLIUM BISCEPTRUM Wats. Bot. King, 351, pl. 37, figs. 1–3 (figure of the flower faulty as respects the base of the filaments), (1871), based on spms. from Downieville, *Bigelow*, Carson City, *Anderson* 288, Washoe Valley, *Stretch* 89.

12. **A. sanbornii** Wood. (Fig. 47e.) Scape 10 to 14 inches high; outer bulb-coats light-colored, reticulation vertical, minutely white dotted or undulated rectangular; pedicels 3 to 8 lines long, perianth-segments white or pinkish (thin and lax in fruit), 2½ to 3 lines long, the outer broadly ovate-lanceolate, the inner narrower; stamens and style ⅔ the length of the segments ("exserted" in the type); filaments opposite inner segments with adnate bases 1½ to 2 times the height of the others; capsule thin-walled, 6-crested, the crests oblong or sometimes lanceolate, conspicuous.

Sierra Nevada from Yuba Co. to Mariposa Co., 1500 to 4000 feet; Santa Lucia Mts. Rare.

Locs.—The type of this species we have not seen, but the following specimens, representing a distinctive natural unit, evidently belong here: Sierra Nevada: Brush Creek, Butte Co., *K. Conger*; Italian Bar, Tuolumne Co., *Jepson* 6375; Bluett's Pt., Tuolumne Co., *A. L. Grant* 709; Devil's Gulch, Mariposa Co., *Congdon*. Coast Ranges: Cold Spr., Big Sur River, *Jepson* 2594.

Var. **congdonii** Jepson n. var. Perianth-segments elliptic-acuminate, very thin, erose; outer bulb coat with vertical reticulation, not undulated. (Segmenta perianthii elliptico-acuminata tenuissima erosa; tunica bulbi exterior ad perpendiculum reticulata non undulata.)—Mariposa Co. (Benton Mills Road, *Congdon*, type; Josephine Mine, *Congdon*).

Refs.—ALLIUM SANBORNII Wood, Proc. Acad. Phila. 20:171 (1868), type loc. Foster's Bar, N. Fork Yuba River, *S. S. Sanborn*; Wats. Bot. King, 486, pl. 37, fig. 7 (1871), Proc. Am. Acad. 14:229 (1879). Var. CONGDONII Jepson.

13. **A. tribracteatum** Torr. Scape rising above the ground only ¼ to 2½ inches, generally slender, channeled and more or less distinctly 4-angled, 2 angles often more prominent; bulb-coats white with minute more or less distinct oblong to hexagonal reticulation; bracts usually 3, short-obovate, acuminate; leaves 1 or 2, linear-lanceolate, 1½ to 5 times as high as the scape; perianth-segments 2 to 4 lines long, narrowly ovate, acuminate to obtuse, silver-white to pinkish with brown or purple midnerve; filaments ⅔ to almost as long as the segments; ovary strongly and angularly 3-lobed, its crests varying from prominent to obscure or none, usually consisting of 2 rounded ridges, with a longitudinal channel between them.

Granite sand, Sierra Nevada, 8000 to 9500 feet, from Lassen Peak south to Kern Co.

Locs.—Pah Ute Peak, *Purpus* 5333; Macomb Ridge, Yosemite Park, *Jepson* 4558; Tuolumne Mdws., *Jepson* 4474; Conness Creek, Tuolumne River, *Jepson* 3361; Sunrise Trail to Lake Merced, *Jepson* 3166 (bracts 2); Hull's Mdw., Tuolumne Co., *A. L. Grant* 1229. Passes into the var. **parvum** Jepson n. comb. Perianth-segments oblong, obtuse.—High Sierra Nevada (7500 to 10,500 feet): Mt. Lyell, *Jepson* 3332 (bracts 2); El Capitan, *Jepson* 4360 (bracts 2 or 3); Nellie Lake, Fresno Co., *A. L. Grant* 1019. Also in the Washoe Mts., Nev. Var. **andersonii** Wats.—Perianth-segments oblong, obtuse, 3 to 5 lines long; bracts 2, rose-purple, broadly ovate, acuminate.—Truckee River basin (Prosser Creek, Nevada Co., *Sonne*; Donner Lake, *Sonne*. Near Carson City, Nev., *Anderson*. *Hall & Chandler* 442 (North Forks Kings River) is similar to the Truckee River plants, but the pedicels are longer (5 to 7 lines).

Refs.—ALLIUM TRIBRACTEATUM Torr. Pac. R. Rep. 4:148 (1856), type loc., Duffield's Ranch, east of Sonora, Tuolumne Co.; Wats. Bot. King, 353, 488, pl. 38, figs. 6–7 (1871). Var. PARVUM Jepson. *A. parvum* Kell. Proc. Cal. Acad. 3:54, fig. 13 (1863), type loc. "Washoe, Nev.," *Veatch*; Wats. Proc. Am. Acad. 14:232 (1879). *A. obtusum* Lemmon, Pitt. 2:69 (1890), type loc. Gold Lake, Plumas Co. *A. parvum* var. *brucae* Jones, Contrib. W. Bot. 10:12 (1902), type loc. Yankee Hill, Butte Co., *C. C. Bruce*. *A. ambiguum* Jones, l.c. 18, type loc. Summit, Nevada Co., *Jones*. Var. ANDERSONII Wats. Bot. King, 353, 488, type loc. near Carson City, Nev., *Anderson* 63, 286 (1871).

14. **A. burlewii** Davidson. Resembling A. tribracteatum; bracts 3 to 5, ovate, acute, with connate bases; leaf solitary, twice the height of the inflorescence; perianth-segments lanceolate-attenuate, 4 to 6 lines long; stamens equal to segments or slightly exserted; style exserted 1 to 2 lines.

Mountains of Southern California, 6700 to 9000 feet.

Locs.—Mt. Pinos, *Hall* 6514; Mt. San Antonio, *Peirson* 2, 4, 266; San Jacinto Mts., *H. W. Anthony*.

Refs.—ALLIUM BURLEWII Davidson, Bull. S. Cal. Acad. 15:17 (1916), type loc. summit Mt. San Antonio, *Fred Burlew*. *A. johnstonii* Jones in litt.

15. **A. hyalinum** Curran. Scape 6 to 14 inches high; bulb-coats gray, with horizontal, strongly undulate to serrate reticulation; leaves generally 1 or 2, linear, channeled; bracts ovate, acuminate; pedicels 6 to 11 lines long; perianth-segments lanceolate to ovate, obtuse or acute, pale pink to white, becoming thin, hyaline and spreading; filaments subulate from a narrowly deltoid base, unequal, ½ to ⅔ the length of the perianth-segments; capsule not crested.

Rocky slopes, Sierra Nevada, 500 to 2600 feet, from Eldorado Co. to Kern Co.

Locs.—Salmon Falls, Eldorado Co., *K. Brandegee*; Drytown, Amador Co., *G. Hansen*; Mariposa, *Congdon*; Sequoia Park, *Walter Fry* 130, 398; Kernville, *T. Brandegee*; Keene, *Heller* 7805.

Var. **praecox** Jepson n. comb. (Fig. 47d.) Scape stouter, leaves broader; pedicels mostly ¾ to 1¼ inches long; reticulation of inner bulb-coats contorted-undulate; perianth-segments acute, longer, with rose-purple midnerve.—San Bernardino to San Diego Co.; Santa Barbara Islands; northern Lower California; Slover Mt., *Parish* 4667; El Cajon, *T. Brandegee*; Santa Cruz Isl., *T. Brandegee*.

Var. **hickmanii** Jepson n. comb. Like the species but scape shorter (3 to 6 inches high); leaves 2 to several, filiform; perianth-segments less hyaline, the midnerve rose-pink.—(Seapus brevior, unc. 3–6 altus; folia filiformia, duo vel plura; segmentis perianthium minus hyalinis.) —Monterey, *E. K. Abbott* (type).

Refs.—ALLIUM HYALINUM Curran, Bull. Cal. Acad. 1:155 (1885), type loc. McKewen's Ranch, near Salmon Falls, Eldorado Co., *Curran*; Wats. Proc. Am. Acad. 24:87 (1889) in part. Var. PRAECOX Jepson. *A. praecox* T. Brandegee, Zoe 5:228 (1908), type loc. San Diego, *T. Brandegee*. *A. campanulatum* Parish, Erythea, 3:60 (1895), not Wats. *A. peninsulare* Jones, Contrib. 10:22 (1902), not Lemmon. Var. HICKMANII Jepson. *A. hickmanii* Eastw. Bull. Torr. Club 30:483 (1903), type loc. between Monterey and Pacific Grove, *Eastwood*.

16. **A. amplectens** Torr. Scape slender, 6 to 13 inches high; bulb-coats commonly reddish, with a delicate transversely sinuate or serrate reticulation, the vertical lines especially also minutely sinuous; leaves narrow and becoming convolute-filiform above the sheathing base; bracts 3, short, abruptly acute; umbel erect, usually dense; pedicels 25 to 35, 3 to 8 lines long; flowers white or nearly so, the oblanceolate acuminate segments 3 to 4 lines long, more or less exceeding the stamens and style; ovary crests low, broad.

Wet often rocky slopes at lower and middle altitudes (1000 to 4000 feet): North Coast Ranges and Sierra Nevada. North to Oregon.

Locs.—Indian Valley, ne. Lake Co., *Jepson* 8989; Hough Sprs., *Jepson* 9014; Mt. Tamalpais, *T. Brandegee*; Vaca Mts., *Jepson*; Red Mt., n. Mendocino Co., *Eastwood*; Kneeland

Prairie, *Tracy* 3844; Union Creek, Trinity Co., *Hall* 8611; Yreka, *Butler* 1358; Rosewood, w. Tehama Co., *Jepson*; Butte Co., *R. M. Austin* 736; Mariposa, *Congdon*; Middle Tule River, *Purpus* 5595.

Refs.—ALLIUM AMPLECTENS Torr. Pac. R. Rep. 4:148 (1857), type loc. Sonoma, *Bigelow*. *A. attenuifolium* Kell. Proc. Cal. Acad. 2:110, fig. 33 (1863), type loc. Mt. Shasta, *Veatch*; Jepson, Fl. W. Mid. Cal. 120 (1901). *A. monospermum* Jepson; Greene, Man. Bay Reg. 321 (1894), type loc. Vaca Mts., *Jepson*. *A. attenuifolium* var. *monospermum* Jepson, l.c.

17. **A. serratum** Wats. Scape 8 to 15 inches high; bulb-coats horizontally serrate-reticulate, the reticulation close but distinct; bracts narrowly acuminate; perianth-segments pink, broadly ovate-lanceolate, 4 to 6 lines long, acute or somewhat acuminate, nearly straight and rather rigid, the inner narrower, somewhat shorter and rarely serrulate; filaments all with a narrowly deltoid base; ovary crests very minute, narrow, central, 2-lobed.

Lower hills of the inner Coast Range from Solano Co. to the Mt. Hamilton Range, thence west to the inner slopes of the Santa Cruz Mts., 300 to 2000 feet.

As here restricted a satisfactory and somewhat localized unit. This species has hitherto been made to do duty over too wide a range. Its umbels have more numerous flowers and its perianth is thinner than in A. peninsulare. After anthesis the tips of the perianth-segments are bent in abruptly and connivent at the center, the whole perianth becoming bladdery inflated.

Locs.—Walker Cañon, Vaca Mts., *Jepson*; Araquipa Hills, Solano Co., *Jepson* 522; Martinez, *Brewer* 994; Lautwasser Creek, *Hall*; Pleasant Valley, Contra Costa Co., *Chandler* 573; Walnut Creek, *Brewer* 1022; Mt. Diablo, *Jepson* 7581; Livermore, *Jepson*; Los Buellis Hills, Santa Clara Co., *R. J. Smith*; Oak Ridge, Mt. Hamilton Range, *R. J. Smith*; Loma Prieta, *Davy* 646.

Refs.—ALLIUM SERRATUM Wats. Bot. King, 487, pl. 37, figs. 4, 5 (1871), type from Cal., *Douglas*; Jepson, Fl. W. Mid. Cal. 120 (1901).

18. **A. dichlamydeum** Greene. Lower than A. peninsulare but very similar; umbels very compact, the pedicels ¼ to ¾ inch long; perianth-segments spreading almost equally, the outer narrowly to broadly elliptic, rounded or as if truncate but shortly acute, the inner for the most part nearly as broad.

Maritime, in a coastal belt from San Mateo Co. to Mendocino Co., extending inland only to the coast-like "island" of vegetation in ne. Contra Costa Co. Bracts 2, commonly united below into a cup; in A. peninsulare they are less united or distinct.

Locs.—Crystal Springs Lake, *C. F. Baker* 809; Mission Hills, *Michener & Bioletti*; Lands End, *H. A. Walker* 179; Antioch, *K. Brandegee*; Bodega Bay, *Chandler* 718; Little River, *Congdon*; Ft. Bragg, *W. C. Mathews* 5.

Refs.—ALLIUM DICHLAMYDEUM Greene, Pitt. 1:166 (1888), type loc. San Francisco. *A. serratum* var. *dichlamydeum* Jones, Contrib. 10:84 (1902).

19. **A. peninsulare** Lemmon. (Fig. 47e.) Habit and bulb-coats of A. serratum, the scapes usually more stocky; pedicels ¾ to 1¼ inches long; perianth-segments deep red-purple, 5 to 7 lines long, the outer 3 broadly ovate-lanceolate, somewhat spreading, twice the breadth and usually ¼ longer than the 3 inner erect attenuate segments which form a sort of inner cup; filaments ½ to ⅔ the length of the segments, those opposite the inner segments with deltoid bases longer than the bases of those alternate; ovary crests central, very minute, narrowly 2-lobed.

Barren or openly wooded hills: cismontane Southern California; Sierra Nevada from Kern Co. to Placer Co.; inner South Coast Range. Also in northern Lower California.

Locs.—Southern California: Santa Catalina Isl., *T. Brandegee*; Sweetwater Dam, *Hall* 3893; Witch Creek, *R. D. Alderson*; Carrizo Creek, *T. Brandegee*; Linda Vista, *T. Brandegee*; Ramona, *T. Brandegee*; Palomar, *Hall* 483; Reche Cañon, San Bernardino Co., *Hall* 1098; Chatsworth Hills, *Hall* 3234; Fish Cañon, San Gabriel Mts., *Peirson* 509. Inner South Coast Range: San Carlos Creek, *Jepson* 2734; Mt. Diablo, *Greene* (perianth-segments denticulate at apex). Sierra Nevada: Kern Cañon, *Heller* 7781; Green Gulch, Mariposa Co., *Congdon*; Hetch Hetchy, *Chesnut & Drew*; Vallecito, *A. L. Grant*; Gwin Mine, Calaveras Co., *Jepson* 1786; Harmon Peak, *Davy* 1430; Newcastle, Placer Co., *Sonne*.

Var. **crispum** Jepson n. comb. Margins of the inner perianth segments strongly undulate-crisped, as if irregularly serrate; filaments broader, nearly sepaloid; ovary crests almost or quite none.—Inner South Coast Ranges from the Mt. Hamilton Range and San Juan River Valley south to San Luis Obispo Co. and the foothills bordering the upper San Joaquin Valley. The crinkly white edges of the inner segments are very striking in living flowers.

Locs.—Mt. Oso, *Brewer* 1246; Playter Valley, *Hall* 9904; Estrella, *L. Jared*; Paso Robles, *Cobb*; Waltham Creek, *Jepson* 2662; Oil City, Kern Co., *Heller* 7740.

Refs.—ALLIUM PENINSULARE Lemmon; Greene, Pitt. 1:165 (1888), type loc. Los Cruces Cañon, near San Rafael Valley, n. Lower California, *Lemmon*. Var. CRISPUM Jepson. *A. crispum* Greene, Pitt. 1:166 (1888), type loc. Paso Robles, *Parry*.

20. **A. bolanderi** Wats. (Fig. 47f.) Scape very slender, (3 or) 6 to 10 inches high; outer corm-coats dense, the reticulation undulate-serrate; bracts 2, 7 to 8 lines long, ovate-lanceolate, acuminate; pedicels 10 to 17, slender, 5 to 10 lines long; flowers rose-color or pinkish, the ovate very narrowly acuminate segments nearly straight, 4 to 5 lines long, twice longer than the stamens and style, inner segments glandular-denticulate; filaments filiform, adnate to the middle, those opposite the inner segments slightly longer; ovary crested by the rounded summits of the lobes.

Usually in dry soil, brushy hills and open woods, from Lake Co. to Siskiyou and Modoc cos., 800 to 2700 feet. Southern Oregon.

Locs.—Scotts Valley, Lake Co., *Tracy* 1667; S. Fork, junction Trinity River, *Jepson* 2024; Rosewood, w. Tehama Co., *Jepson*; Oak Run, Shasta Co., *Baker & Nutting*; Quartz Valley, Siskiyou Co., *Butler* 1469; Deep Creek, Warner Mts., *L. S. Smith*. Specimens collected by K. Brandegee between Antioch and Marsh Creek have corms and outer coat like A. bolanderi and the habit and flowers of A. serratum.

Var. **stenanthum** Jepson n. comb. Taller with paler (white to pink) flowers and narrower segments.—Eastern and northeastern Humboldt Co.: Klamath River, *Chandler* 1434; Three Creeks to Willow Creek, *Jepson* 1978.

Refs.—ALLIUM BOLANDERI Wats. Proc. Am. Acad. 14:229 (1879), type loc. Eureka Trail, *Bolander* 6556; Jepson, Fl. W. Mid. Cal. 119 (1901). Var. STENANTHUM Jepson. *A. stenanthum* Drew, Bull. Torr. Bot. Club 16:152 (1889), type loc. e. slope Pilot Ridge, Humboldt Co., *Drew*.

21. **A. acuminatum** Hook. (Fig. 47g.) Scape 4 to 8 inches high; outer bulb-coats with a distinct coarse quadrate to hexagonal reticulation; pedicels (numbering 12 to 30) 6 to 12 lines long; flowers deep rose-color, 4 to 7 lines long; segments broadly lanceolate with acuminate recurved tips, a third longer than the stamens, undulate-serrulate above the base; filaments with lower third adnate and dilated; ovary with 6 blunt central crests.

Dry interior hills, Humboldt, Siskiyou and Modoc cos. North to British Columbia and east to Colorado.

Locs.—Hupa, *Chandler* 1349; Yreka, *Butler* 788; Buck Creek, Warner Mts., *L. S. Smith* 938.

Refs.—ALLIUM ACUMINATUM Hook. Fl. Bor. Am. 2:184, t. 196 (1839), type loc. Nootka Sound, British Columbia, *Menzies*; Wats. Bot. King 352, pl. 37, fig. 6 (1871).

22. **A. lacunosum** Wats. (Fig. 47h.) Scape 3 to 6 inches high; bulb-coats light colored, thick and distinctly pitted by the quadrate or transversely oblong reticulation; umbels 10 to 20-flowered, the pedicels 3 to 5 lines long; bracts broadly ovate, tipped with a slender-subulate point; flowers small (3 lines long); perianth-segments pinkish to rose-color with darker or red midnerve, oblong-lanceolate and acuminate, or oblong and acute, a little exceeding the stamens; filaments narrowly deltoid below; each ovary-cell with an obtuse thickened ridge toward the summit on each side, the ridges uniting to form a broad often slightly lobed crest.

Arid areas, mostly toward the interior, central and Southern California, at widely scattered stations.

Locs.—Mariposa Peak; Kernville, *T. Brandegee*; Argus Mts., Inyo Co., *Purpus* 5430; Palm Cañon, Mt. San Jacinto, *Jepson* 1392; Arraster Cañon, San Gabriel Mts., *Pearson* 426; Santa Rosa Isl., *T. Brandegee*.

Refs.—ALLIUM LACUNOSUM Wats. Proc. Am. Acad. 14:231 (1879), type loc. Mariposa Peak, Mt. Hamilton Range, *Brewer* 1284; Jepson, Fl. W. Mid. Cal. 120 (1901).

23. **A. platycaule** Wats. Scape 2 to 5 (or 6) inches high, 2 to 4 lines broad; bulb ½ to 1 inch broad; leaves ½ to 1 inch broad; flowers numerous, rose-color with tips pale greenish tinged, 4 to 7 lines long, on pedicels approximately 1 inch long; segments lanceolate, very narrowly long-acuminate; stamens conspicuously exserted; ovary lobes rounded, not crested.

High valleys, Sierra Nevada from Placer Co. to Modoc Co.

Locs.—Truckee River, Placer Co., *Sonne*; Webber Peak, *G. E. Poore*; Red Clover Creek, Plumas Co., *Hall & Babcock* 4458; Susanville, *T. Brandegee*; Bowman ranch, Warner Mts., *E. H. Steffen*; Deep Creek near Cedarville, *L. S. Smith* 1123; Lake City, *Manning*.

Refs.—ALLIUM PLATYCAULE Wats. Proc. Am. Acad. 14:234 (1879), based on spms. from n. Sierra Nevada (Placer Co. to Plumas Co.). *A. anceps* Baker, Bot. Mag. t. 6227 (1876), not Kell.

24. **A. anceps** Kell. Scape 5 to 6 inches high, 1 to 1½ lines broad; bulb-coats faintly and transversely rectangular-reticulated; leaves somewhat falcate, 1½ to 2½ lines broad; flowers numerous, pale rose-color without dark midveins, 3 to 4 lines long, on pedicels 6 to 8 lines long; segments oblong or linear-lanceolate, acuminate, only slightly or not at all exceeding the stamens; ovary cells with a thin curving ridge at summit which is truncatish or notched above.

East of the Sierra Nevada crest from Sierra Co. north to Oregon and east to western Nevada.

Locs.—Sierra Co., acc. Watson; Madeline Plains, Lassen Co., *C. C. Bruce*. Carson City (*Anderson*) and Reno (*Cowgill*), Nev. Also Bear Valley, San Bernardino Mts., acc. *Parish* (Pl. World, 20:208).

Var. **lemmonii** Jepson n. comb. Perianth-segments shortly lanceolate-acuminate, 2½ to 3 lines long; ovary cells with 2 low narrow parallel or somewhat sinuous ridges; stigma undivided. —Northern Sierra Nevada: Prosser, Nevada Co., *Sonne*.

Refs.—ALLIUM ANCEPS Kell. Proc. Cal. Acad. 2:109, fig. 32 (1863), type loc. Washoe, Nev., *Veatch.*; Wats. Bot. King, 352, pl. 36, figs. 4–6 (1871). Var. LEMMONII Jepson. *A. lemmonii* Wats. Proc. Am. Acad. 14:234 (1879), type loc. Sierra Co., *Lemmon*.

25. **A. modocense** Jepson n. sp. Scape flattened, 1½ to 2 (or 4) inches high, prominently nerved, the 1 or 2 leaves twice as high; reticulation of the bulb-coat none or faintly and transversely quadratish; umbel 20 to 30-flowered, the pedicels 6 to 8 lines long; bracts 2; perianth segments white with broad pink midveins, oblong-lanceolate, 5 to 7 lines long; filaments ⅔ as long as the segments, adnate by the lower ¼ and united by the dilated bases into a low but distinct cup; ovary cells with 2 low thin ridges confluent above and thus forming a single curved obtuse crest.—(Scapus planus, unc. 1½–2 vel 4 altus, folia 1–2, duplo alta; filamenta basi dilatata adnata breviter cupuliformia; lobi ovarii cristis singulis obtusis curvatis.)

Gravelly soil, 5000 to 7000 feet: Modoc Co.

Locs.—Jess Valley, *E. H. Steffen* 803 (type); Goose Lake Valley, *R. M. Austin*.

A. NEVADENSE Wats. Bot. King, 351, pl. 38, figs. 1–3 (1871), type loc. Trinity Mts. to the East Humboldt Mts., Nev., is (ex. char.) very similar to A. modocense but the scapes are terete and the reticulation of the bulb-coats rather minute and very much distorted. We have seen no specimens from California, although it may be expected along the eastern boundary north of Nevada Co.

26. **A. falcifolium** H. & A. (Fig. 47i.) Scape 2 to 3 or 4 inches high, conspicuously flattened (1 to 3 lines broad) and 2-winged, at least above; bulb-coats not reticulated; leaves 3 to 5 lines broad; bracts 2, nearly or quite as long as the flowers; flowers rose-colored, the lanceolate segments acute and erect or attenuate and slightly spreading above, often very minutely glandular-serrate, 4 to 7 lines long; stamens ½ to ¾ the length of the segments; ovary 3-lobed, the lobes creased down the middle and produced above into narrow slightly toothed crests.

Shallow soil on rock rifts or ledges: North Coast Ranges from Napa Co. to Siskiyou Co., 1500 to 6500 feet. North to Oregon.

Locs.—Conn Valley, Napa Co., *Jepson* 6250; Pope Valley, *Saidee Wallace*; Middletown grade, ne. of Mt. St. Helena, *Jepson*; Buck Mt., *Tracy* 4164; Yreka, *Butler* 1167.

Var. **demissum** Jepson n. var. Plants small, 1 to 2 inches high; leaves 2, greatly exceeding the scape; bracts 2; pedicels 3 to 6 lines long; flowers small, 3 lines long, deep red purple.—(Pumila, unc. 1 2 alta; folia 2; flores parvi, lin. 3 longi, atro-purpurei.)—High montane, loose rocky soil, 6000 to 8000 feet, w. Siskiyou Co.: Devil's Backbone, *Jepson* 2069; Marble Mt., *Jepson* 2830 (type).

Refs.—ALLIUM FALCIFOLIUM H. & A. Bot. Beech. 400 (1841), type from Cal., *Douglas*; Wats. Bot. King. 488, pl. 36, figs. 7, 8 (1871); Jepson, Fl. W. Mid. Cal. 119 (1901). Var. DEMISSUM Jepson.

27. **A. breweri** Wats. Very close to A. falcifolium but smaller; scape not 2-winged; leaves two, 2 to 5 lines broad; bracts 2, little exceeding the pedicels; umbel compact, the pedicels 4 to 7 lines long; perianth light rose color, its segments 5 to 6 lines long, mostly erect; stamens ⅔ as long as the segments; ovary crests consisting of a curved ridge, the apex of the crest or curved ridge short and entire or obscurely emarginate.

Mountain summits of the Mt. Diablo, Mt. Hamilton and Santa Cruz ranges, 3500–4500 feet.

Locs.—Mt. Diablo, *Congdon*; Mt. Hamilton, *Pendleton* 889; Santa Cruz Mts., *C. F. Baker* 539.

Refs.—ALLIUM BREWERI Wats. Proc. Am. Acad. 14:233 (1879), type loc. Mt. Diablo, *Brewer* 1060. *A. falcifolium* var. *breweri* Jones, Contrib. 10:83 (1902). The distinctions implied by Watson (Bot. Cal. 2:151) between A. breweri and A. falcifolium do not hold. There is no definite distinction as to stamen length and A. breweri may have glandular-serrulate perianth-segments (*Brewer* 1060) as well as A. falcifolium. Nevertheless we retain the two as species on other grounds.

14. **MUILLA** Wats.

Like Allium, but the herbage without the taste or odor of onions. Scape from a fibro-membranous coated corm and bearing an umbel subtended by 3 acuminate scarious bracts, which are distinct even in the bud, or slightly connate and overlapping at the base; pedicels not jointed at the summit, but subtended by small unequal membranous bractlets. Leaves very narrow, flat to terete. Flowers greenish or yellowish-white. Perianth sub-rotate, persistent, of 6 nearly equal segments; segments slightly united at base, oblong, with a dark 2-nerved mid-rib (alternate segments occasionally 3-nerved). Stamens inserted near the base. Ovules 8 to 10 in each cell; style clavate, persistent and at length splitting. Capsule globose, scarcely lobed, loculicidal. Seeds compressed and angled.—Species 4, California, Nevada and Mexico. (Anagram of Allium.)

Filaments filiform or subulate.
  Perianth without glands........................1. *M. maritima.*
  Inner perianth-segments with pit-like glands........................2. *M. serotina.*
Filaments greatly dilated, retuse at apex........................3. *M. coronata.*

1. **M. maritima** Wats. (Fig. 48a.) Scapes 3 to 9 (or 12) inches high, generally equal to or a little taller than the narrowly linear almost terete leaves; umbel 4 to 12-flowered; pedicels unequal, ¼ to 1 inch long; perianth-segments 2 to 3 lines long, acute to obtuse, the inner generally wider, with broad thickened brownish midnerve and thin greenish-white margins; filaments filiform to subulate; anthers yellow or lurid purple.

Alkaline fields, Sacramento Valley and Marin Co. to Southern California.

Locs.—Vacaville, *Jepson* 1196, 8218; Stege, *Davy* 6527; Mission Hills, San Francisco, *Bioletti*; Crystal Springs Lake, San Mateo Co., *C. F. Baker* 423; Alviso, *Bioletti*; San Martin, *Chandler* 921; Hemet Valley, *Hall* 1138; Escondido, *Alice King;* La Mesa, *Jepson* 6677.

Refs.—MUILLA MARITIMA Wats. Proc. Am. Acad. 14:235 (1879); Jepson, Fl. W. Mid. Cal. 118 (1901). *Hesperoscordium(?) maritimum* Torr. Pac. R. Rep. 4:148 (1857), type loc. Pt. Reyes, *Bigelow. Bloomeria maritima* McBr. Contrib. Gray Herb. 56:8 (1918).

MUILLA TRANSMONTANA Greene, Pitt. 1:73 (1887), type loc. Reno, Nev. *Bloomeria transmontana* McBr. Contrib. Gray Herb. 56:8 (1918). Scape fusiform enlarged at the ground; perianth white.

2. **M. serotina** Greene. Scape taller (14 to 20 inches high); leaves fewer; umbel 10 to 20 (or 40)-flowered; perianth dull white, with very broad green veins to the segments.

Half-open foothills: upper San Joaquin Valley; more common in the mountains or towards the interior of Southern California.

Locs.—Alcalde, *T. Brandegee;* Pasadena, *G. B. Grant* 803; San Jacinto River, *Hall* 519; San Diego, *T. Brandegee;* Blair Valley, e. San Diego Co., *Jepson* 8701.

Refs.—MUILLA SEROTINA Greene, Pitt. 1:152 (1893), type loc. Los Angeles, *Davidson* 2052. *M. tenuis* Congdon, Zoe 5:35 (1901), type loc. Raymond, Madera Co., *Congdon,* may be a synonym.

3. **M. coronata** Greene. (Fig. 48b.) Scape 1½ to 2 inches high; perianth-segments with narrow white scarious border; filaments hyaline, broadly oblong, retuse at summit, the anther on a short inflexed slender cusp arising from the notch.

Antelope Valley, western Mohave Desert.

Ref.—MUILLA CORONATA Greene, Pitt. 1:165 (1888), type loc. Lancaster, Mojave Desert, *Parry.* Well marked by its peculiar filaments.

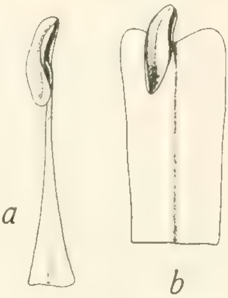

Fig. 48. *a*, MUILLA MARITIMA Wats., stamen, × 16; *b*, M. CORONATA Greene, stamen, × 16.

15. BLOOMERIA Kell.

Stem scapose, from a fibrous-coated corm. Leaves linear, carinate. Umbel with many yellow flowers; pedicels jointed at the summit and subtended by membranous bracts. Perianth persistent, of 6 nearly equal distinct segments. Stamens 6, inserted on the base of and rather shorter than the segments; filaments filiform, margined at base by wing-like appendages. Capsule sub-globose; seeds 2 to several in each cell, angular and wrinkled; style 1, persistent and splitting with the loculicidal capsule.—Species 2. (H. G. Bloomer, a pioneer botanist of San Francisco.)

Stamen appendages papillose; style as long or longer than the ovary .... 1. *B. crocea.*
Stamen appendages smooth, fleshy; style shorter than the ovary.......................2. *B. clevelandii.*

1. **B. crocea** Cov. GOLDEN BLOOMERIA. Scape 6 to 14 inches high, minutely scabrous; leaves 2, 2 to 3 lines wide, one of them as long as the scape; pedicels 30 to 50, 1½ to 2 inches long; bracts several, subulate-lanceolate; perianth-segments orange-yellow, linear-oblong, sub-rotate, 5 to 6 lines long, striped with 2 closely parallel dark lines; lower ⅔ or ½ of the stamen appendages adnate to the perianth, the upper free portion ending in a nectar-bearing often bicuspidate cup bearing the filament; capsule nearly 3 lines long.

South Coast Ranges, east to the Sierra Nevada of Kern Co. and south to cismontane Southern California. May-June.

Locs.—Pacheco Pass; San Antonio Creek, Monterey Co.; Morro, San Luis Obispo Co., *Barber*; Santa Barbara, *Dunn*; Ojai Valley, *Olive Thacher*; Rubio Cañon, foothills east, *Peirson* 6; Cajon Pass, *Jepson* 6107; Mentone, *Parish*; Vandeventer, *Jepson* 1334; San Diego, *Orcutt*; Santa Rosa and Santa Catalina islands (Zoe, 1:145); Santa Cruz Isl., *Greene*.

Refs.—BLOOMERIA CROCEA Cov. Contrib. U. S. Nat. Herb. 4:203 (1893). *Allium croceum* Torr. Bot. Mex. Bound. 218 (1859,—at least as early as Sept.), type loc. summit of the mountains e. of San Diego, *Parry*. *Bloomeria aurea* Kell. Hesperian, 3:437 (Dec. 1859); Proc. Cal. Acad. 2:11, pl. (1863), type loc. New Idria, *Veatch*. *Nothoscordum aureum* Hook. f. Bot. Mag. t. 5896 (1871). *Bloomeria montana* Greene, Bull. Cal. Acad. 1:281 (1885), type loc. near Tehachapi, *Curran.*

2. **B. clevelandii** Wats. Scape stout, 3 to 12 inches high; leaves several, narrow (1 line wide or less); pedicels 20 to 30, slender, 1 to 1¼ inches long; inner flowers of the umbel maturing slowly; perianth-segments yellow with a green stripe, linear-elliptic, 3 to 4 lines long; stamen appendages oblong, entire, obtuse at the summit, adnate to the perianth-segments, only ⅕ their length; capsule 2 to 2½ lines long.

Mesas near San Diego.

Ref.—BLOOMERIA CLEVELANDII Wats. Proc. Am. Acad. 20:376 (1885), type loc. mesas, San Diego.

16. **BRODIAEA** Sm.

Stem scapose, arising from a corm, erect and straight, or sometimes elongated and twining. Leaves mostly few and grass-like. Flowers in a loose or capitate umbel. Pedicels jointed beneath the perianth. Perianth-tube various. Stamens 6, or the alternate stamens replaced by dilated sterile filaments or staminodia. Filaments slender or more frequently winged and produced beyond the anther in the form of thin appendages. Ovary on a short stipe or sessile. Capsule loculicidal, beaked by the style which splits with the valves.—Species about 40, western North America and in South America, especially Chile. (James Brodie, Scotch botanist.)

While the species of Brodiaea are somewhat diverse in floral characters, especially as to perianth and stamens, the flower is after all reducible to one sufficiently definite generic plan. In any event if we accept more than one genus there must logically be at least seven. In various particulars, however, the various sections (which are by some authors accepted as genera) overlap in a manner that is genetically significant. While Brodiaea volubilis (genus *Stropholirion* Torr.) is remarkable for its long twining stem, at the same time Brodiaea pulchella (genus *Dipterostemon* Rydb.) is often very tortuous at summit of its long stem, a character which is often perceivable too in B. capitata and B. multiflora (genus *Dichelostemma* Kunth) and, what is most significant from the viewpoint of a single genus, even sometimes in B. coronaria (genus *Hookera* Sm.). The perianth tube is markedly inflated in B. volubilis and B. capitata, but this character is also more or less evident in B. pulchella and there is even a suggestion of it in B. minor and B. synandra and perhaps in B. californica. The staminode character is so very unsteady and even erratic that it has no generic value. The total evidence in favor of the close genetic connection of these species is very convincing.

Variation within the species is also very marked. Brodiaea coronaria, minor, filifolia, laxa, ixioides, hyacinthina, and capitata, are especially variable in habit and size, developing a large number of forms, which seem evidently related to the habitat, but are also inconstant in certain of the structural details of the flowers (such as the staminodes) as well as in color. There is at present sufficient material available of the above types to furnish a sort of basis for perhaps sixty species instead of seven, but these would in our opinion quite lack definiteness, since the habital features are not correlated with structural variations in the flowers and the intergrades are too numerous. The staminodia in B. minor and grandiflora are very variable in size and shape, as are the filaments in B. ixioides. B. laxa often has pale or nearly white flowers, B. minor rose-colored ones; B. ida-maia has been found with buckskin color flowers and apparently B. crocea may occur in a pale blue form. The capsules of some, perhaps all, Brodiaeas have good characters but our fruiting material is too inadequate for complete differential fruit diagnoses.

Bibliog.—Smith, J. E., Characters of a new Liliaceous genus called Brodiaea (Trans. Linn. Soc. 10:1–5,—1811). Greene, E. L., Some genera confused under the name Brodiaea (Bull. Cal. Acad. 2:125–144,—1886). Britten, J., Hookera vs. Brodiaea (Jour. Bot. 24:49–51,—1886). Baker, E. G., The Genus Brodiaea and its Allies (Gard. Chron. ser. 3, 20:213–214, 238–239, 459, 687, figs. 36–41, 44–47, 79–81, 117–120,—1896).

A. **Umbels loose; stamens 6; anthers versatile (basifixed in no. 7), ovate or ovate-lanceolate; ovary on a long or short stipe; pedicels nearly equal, rather lax; corms somewhat flattened; leaves $1/4$ to $1/2$ inch wide (except no. 4).**—Subgenus TRITELIA.

Filaments filiform.
  Flowers commonly blue or purple, sometimes pale or nearly white; ovary on a long slender stipe.
    Pedicels 1 to $1\frac{1}{2}$ times the perianth.
      Stamens in one row; filaments deltoid; restricted range..........1. *B. bridgesii.*
      Stamens in 2 rows; filaments not deltoid; mostly adobe or clay fields and hillsides, common and widely distributed..........2. *B. laxa.*
    Pedicels 3 to 6 times the perianth; low wet ground mostly near the coast..........3. *B. peduncularis.*
  Flowers yellow; ovary equaling or longer than the stipe.
    Filaments long, slender, sub-equal; leaves 1 to 2 lines wide..........4. *B. gracilis.*
    Filaments short, about equaling anthers, in 2 rows; leaves $1/4$ to $1/2$ inch wide..........5. *B. crocea.*

Filaments dilated.

Flowers yellow; filaments forked at apex, the anther borne on a cusp in the middle of the notch..........6. *B. ixioides.*

Flowers white; filaments with broadly triangular and slightly united bases .7. *B. hyacinthina.*

B. Umbels loose or mainly so; stamens 3, alternating with staminodia; anthers basifixed, sagittate; pedicels very unequal, firm; flowers blue to violet-purple or rose-color; corms not flattened; ovary short-stipitate; leaves narrowly linear to terete.—Subgenus HOOKERA.

Scapes almost wholly subterranean, the umbel sessile on the ground; staminodia yellowish.......8. *B. terrestris.*

Scapes 3 to 20 inches high; staminodia white or purple.

Perianth-segments linear, rotate, nearly twice as long as the tube; throat of tube strongly constricted; staminodia purple..........9. *B. minor.*

Perianth-segments oblong, 1 to 1½ times as long as the tube; throat of tube little or not at all constricted; staminodia white.

Filaments winged on each side with an appendage half as long as the anthers..........10. *B. stellaris.*

Filaments not winged.

Flowers rose-red; staminodia hugging the approximate anthers..........11. *B. rosea.*

Flowers blue; anthers approximate in center around style.

Staminodia erect or spreading.

Staminodia oblong-lanceolate, mostly acute; scape stout, 7 to 20 inches high. 12. *B. coronaria.*

Staminodia scale-like, triangular, acuminate; scape slender, 4 to 12 inches high..........13. *B. filifolia.*

Staminodia approximate in center.

Staminodia plane, about half as long as the spreading or recurving perianth-segments..........14. *B. synandra.*

Staminodia involute, nearly as long as the erect perianth-segments..........15. *B. californica.*

C. Umbels capitate or congested; anthers basifixed, nearly sessile; staminodia always present; perianth-tube more or less inflated and angular, or saccate; ovary sessile or short-stipitate; scapes often tortuous or twining; leaves linear.—Subgenus DICHELOSTEMMA.

Stamens 6; inner filaments with 2 lanceolate appendages extended beyond the anthers; bracts elliptic, acute, very conspicuous, of a deep violet-purple or metallic color; capsule sessile. 16. *B. capitata.*

Stamens commonly 3; bracts acuminate, not so conspicuous.

Flowers blue-purple; staminodia petaloid; pedicels 1 to 3 lines long; umbel capitate; capsule sessile.

Staminodia deeply parted with a minute cusp or reduced filament in the notch; umbel more or less produced into a short dense raceme..........17. *B. pulchella.*

Staminodia entire, forming a corona; umbel not produced-racemose....18. *B. multiflora.*

Flowers rose-red; pedicels ¾ to 1½ inches long; umbel less capitate; capsule triangular ovate, acuminate, on a short stipe.

Staminodia anther-like; perianth 6 to 8 lines long, rose-red or pinkish; flowers erect or nearly so..........19. *B. volubilis.*

Staminodia broadly deltoid, forming a conspicuous corona; perianth 1 to 1¼ inches long; flowers pendulous.

Perianth-tube scarlet, its segments chrome-green..........20. *B. ida-maia.*

Perianth wholly rose-purple..........21. *B. venusta.*

1. **B. bridgesii** Wats. Stems low (5 to 9 inches high); flowers pale lilac, aging bluish; perianth-tube long and very attenuate at base; filaments in 1 row, deltoid at base; ovary stipe 8½ to 10½ lines long.

Open woods, interior of Humboldt Co. to Shasta Co. and south to Mariposa Co., 500 to 3000 feet. Also in southern Oregon. Very similar to B. laxa.

Locs.—Hupa, *Jepson* 2026; Happy Valley, Shasta Co., *W. W. Jones*; Gold Run, *Sonne*; Angels Camp, *Davy* 1485; Mariposa, *Congdon*.

Refs.—BRODIAEA BRIDGESII Wats. Proc. Am. Acad. 14:237 (1879), type loc. Sierra Nevada foothills, *Bridges* 338. *Tritelia bridgesii* Greene, Bull. Cal. Acad. 2:141 (1886). *Hookera bridgesii* Ktze. Rev. Gen. 2:712 (1891).

2. **B. laxa** Wats. Grass Nut. (Fig. 49a, b.) Scape 1 to 2¼ feet high, rigid and stoutish, from a usually deep-seated edible corm; umbel 8 to 48-flowered; pedicels 1 or mostly 2 to 3½ inches long; perianth violet-purple, rarely white, 1¼ to 1¾ inches long, funnel-form, clavate at base, its segments shorter than the tube; stamens 6, all anther-bearing; filaments inserted in 2 rows high on the perianth-tube, 2 lines long; anthers ovate-lanceolate with a 2-lobed base, 1½ lines long; ovary on a slender stipe ½ to ¾ inch long.

Showy and beautiful species, common in adobe fields or on adobe hillsides: Coast Ranges, Santa Cruz and Santa Clara cos. north to Humboldt and Tehama cos., thence south in the Sierra Nevada foothills (500 to 4600 feet) to Tulare Co. Apr.-June.

Very variable in stature, size of umbels and color of flowers; in rich adobe sometimes gigantesque and with large flowers, in sterile clays sometimes dwarfed and with small umbels and small flowers, sometimes with very pale flowers as in the Kaweah River region, or with white flowers in wet places. At the beginning of anthesis the style and the ovary on its long stipe lie along the lower side of the perianth; after the anthers shed their pollen the style arches and stands in the center of the tube. Sheep are fond of this plant; they run along eagerly cropping it, leaving the grass in which it stands. Called Wally-Basket in Tuolumne Co. Ithuriel's Spear is a parlor name.

Locs.—Coast Ranges: Near Monterey, acc. Mary S. Clemens; Los Gatos, *Heller* 7389; Berkeley Hills, *Helen Bergfried*; Mt. Diablo, *Jepson* 7569, 8332; Inverness, *Jepson* 557; St. Helena, *Jepson* 2428; Araquipa Hills, Solano Co., *Jepson* 523; Knoxville ridge, ne. Napa Co., *Jepson* 9046; College City, Colusa Co., *Alice King*; Mt. Sanhedrin, Lake Co., *Hall*; Fort Seward, Humboldt Co., *Tracy* 4453; Eureka, *Tracy* 3711 (white-flowered); Crane Creek, w. Tehama Co., *Jepson*. Sierra Nevada: Oroville, *Heller* 10708; Avery Sta., Calaveras Co., *A. L. Grant*; Columbia, *Jepson* 6349; Limekiln Creek, Tulare Co., *Jepson* 2802; Nelson, Middle Tule River, *Jepson* 4865.

Var. **candida** Jepson n. comb. Pedicels abruptly bent at summit so that the flowers all face horizontally in one direction; flowers white, sometimes blue.—Sierra Nevada foothills, Fresno Co. to Kern Co.

Refs.—Brodiaea laxa Wats. Proc. Am. Acad. 14:237 (1879); Jepson, Fl. W. Mid. Cal. ed. 2, 101 (1911). *Tritelia laxa* Benth. Trans. Hort. Soc. Lond. ser. 2, 1:413, pl. 15, fig. 2 (1835), type from Cal., *Douglas*; Lindl. Bot. Reg. t. 1685 (1835). *Hookera laxa* Ktze. Rev. Gen. 2:712 (1891). *Tritelia angustiflora* Heller, Bull. S. Cal. Acad. 2:66 (1903), type loc. Tiburon, *Heller* 5728. Var. candida Jepson. *Tritelia candida* Greene, Bull. Cal. Acad. 2:139 (1887), type loc. foothills east of Fresno, *J. R. Scupham*. *Brodiaea candida* Baker, Gard. Chron. 20:239 (1896).

3. **B. peduncularis** Wats. Scape erect, 1¼ to 3 feet high; umbel 3 to 15-flowered, the pedicels slender, 2½ to 4 or even 7 inches long; perianth pale rose-purple or nearly white, 6 to 9 lines long, the segments longer than the tube, widely-spreading; ovary yellow, its stipe 1½ to 3 lines long.

Low wet ground, mostly near the coast; Marin Co. north to Humboldt Co., east to Lake Co. June-July.

Biol. Note.—The underground organs have a peculiarity in vegetative multiplication which is peculiar to this species. The corms develop offsets ending in bulblets, the offsets produced through the bulblet (as it were) in the form of a short point (J. P. Tracy).

Locs.—Tiburon, *H. A. Walker* 1725; Point Reyes, *Davy* 6688; Bodega, *Chandler* 676; Moore's Creek, Howell Mt., *Tracy* 2213; Indian Valley, Lake Co., *Jepson* 8988; Eureka, *Tracy* 1920.

Refs.—Brodiaea peduncularis Wats. Proc. Am. Acad. 14:237 (1879); Jepson, Fl. W. Mid. Cal. ed. 2, 102 (1911). *Tritelia peduncularis* Lindl. Bot. Reg. sub t. 1685 (1835), type from Cal., *Douglas*. *Hookera peduncularis* Ktze. Rev. Gen. 2:712 (1891); Jepson, l.c. ed. 1, 117 (1901).

4. **B. gracilis** Wats. Scape 2 to 10 inches high; leaves narrow (1 to 2 lines wide); bracts short, lanceolate; umbel 13 to 29-flowered; flowers dull or saffron yellow, 5 to 7 lines long, on pedicels 4 to 10 lines long; perianth-segments with a brown streak outside, the narrow tube equaling or shorter than the segments; anthers blue, very small; filaments slender, elongated, sub-equal; ovary ovate, equaling stipe.

Granite sand spots on domes and granite ridges: Sierra Nevada, Mariposa and Tuolumne cos. and Plumas Co., 8000 to 9000 feet.

Locs.—Lake Tenaya, *Hall & Babcock* 3523; Conness Creek, Tuolumne Cañon, *Jepson* 3359, 4482; Tamarack Flat, Mariposa Co., *Jepson* 8350; El Capitan, Yosemite, *Jepson* 4361.

Refs.—BRODIAEA GRACILIS Wats. Proc. Am. Acad. 14:238 (1879), type loc. Spanish Peak, Plumas Co., *R. M. Austin*. *Tritelia gracilis* Greene, Bull. Cal. Acad. 2:141 (1886). *Hookera gracilis* Ktze. Rev. Gen. 2:712 (1891).

5. **B. crocea** Wats. (Fig. 49c.) Scape 4 to 12 inches high; leaves 2 to 6 lines broad; bracts linear, elongated; umbels 4 to 8 or 15-flowered; flowers golden or bright yellow, 7 to 9 lines long, on pedicels 3 to 9 lines long, the segments a little longer than the turbinate tube; filaments nearly equaling anthers, in 2 rows; ovary obovate, shorter than the stipe, its angles with a very narrow band of short hairs or scales.

Western Siskiyou Co. and Del Norte Co., 5000 to 7000 feet.

Locs.—Humbug Mt., Siskiyou Co., *Butler* 786; Shackelford Cañon, Marble Mt., *Chandler* 1695; near Preston Peak, *Jepson* 2877.

Refs.—BRODIAEA CROCEA Wats. Proc. Am. Acad. 14:238 (1879). *Seubertia crocea* Wood, Proc. Acad. Phila. 20:172 (1868), type loc. Yreka, *Wood*. *Tritelia crocea* Greene, Bull. Cal. Acad. 2:141 (1886). *Hookera crocea* Ktze. Rev. Gen. 2:712 (1891).

BRODIAEA MODESTA Hall (Univ. Cal. Pub. Bot. 6:166,—1915, type loc. Castle Lake, Siskiyou Co., *J. J. Condit*). This interesting and curious plant is closely related to B. crocea. It is like B. crocea in habit, and its flowers in size and in detail of parts are like those of that species or essentially so, even to the line of pubescence on the angles of the ovary; it differs from B. crocea in its pale or violet-blue perianth. It (with any other associated Brodiaea species) should be studied in its region and re-collected in a full series of specimens. It seems identical with B. crocea and yet it would be rather unusual for a yellow species to throw a blue flower.

6. **B. ixioides** Wats. Golden Brodiaea. (Fig. 49d, e.) Scape ½ to 1½ feet high, usually scabrous; leaves 2, 7 to 14 inches long; umbel 16 to 40-flowered; pedicels ¾ or mostly 1 to 4 inches long; flowers 7 to 11 lines long, salmon-yellow, with a conspicuous black-purple vein on the outside running from the apex to the base of each segment; stamens yellow, alternately long and short, the filaments winged, slenderly 2-forked at the summit, the oblong anthers on a cusp in the notch; forks of the filament a little exceeding or somewhat shorter than the anthers.

Higher foothills of the Sierra Nevada from Tuolumne Co. to Kern Co., 1300 to 5000 feet, common and often abundant; also in Monterey and San Benito cos. and Tehama Co.

Locs.—Coast Ranges: Carmel River Valley, *Ferguson* 256; San Juan, San Benito Co., *Alma Ames*; Manzanita Flat, w. Tehama Co., *Jepson*. Sierra Nevada: Butte Co., foothills acc. *Boerker*; Columbia, Tuolumne Co., *Jepson* 6303; Crockers, Big Oak Flat road, *Jepson* 8349; Yosemite, *Jepson* 4282; Kinsley, Mariposa Co., *Charlotte M. Hoak*; Dinkey Grove, Fresno Co., *A. L. Grant* 1196; Dunlap, Fresno Co., *Jepson* 2756; Colony Mill, Marble Fork, Kaweah River, *Jepson* 641; Nelson, Middle Tule River, *Jepson* 4867; Caliente, *Heller* 7623.

Var. **lugens** Jepson. Generally smaller and more slender; filaments broadly winged, merely emarginate or retuse at apex, the alternate ones triangular-acuminate; anthers white or blue; perianth-tube dark brown, approaching black.—Sandy slopes, Sierra Nevada, 6000 to 8000 feet; North Coast Ranges, towards the interior, 2400 feet.

Locs.—Sierra Nevada: Long Lake, Plumas Co., *Hall* 9350; Tallac, *C. J. Fox Jr.*; Calaveras Big Trees, *A. L. Grant*; Little Yosemite, *Jepson* 3151; Seavy Pass, Yosemite Park, *Jepson* 4515; Lake Merced, *Jepson* 4406; Miami Lodge, Mariposa Co., *Jepson* 8399; Bear Creek, Fresno Co., *Hall & Chandler* 420; Hockett Mdws., Tulare Co., *Hall & Babcock* 5601. North Coast Ranges: Howell Mt., *Tracy* 1450; Vaca Mts., *R. H. Platt*.

Refs.—BRODIAEA IXIOIDES Wats. Proc. Am. Acad. 14:238 (1879); Jepson, Fl. W. Mid. Cal. ed. 2, 101 (1911). *Ornithogalum ixioides* Ait. f. Hort. Kew. 2:257 (1811), type from Cal., *Menzies*, undoubtedly collected at Monterey. *Tritelia ixioides* Greene, Bull. Cal. Acad. 2:142 (1886). *Hookera ixioides* Ktze. Rev. Gen. 2:712 (1891). *Calliprora lutea* Lindl. Bot. Reg. t. 1590 (1833); Hook. Bot. Mag. t. 3588. The scapes in the typical form are often more or less scabrous and therefore we cite here: *Calliprora scabra* Greene, Erythea 3:125 (1895), type loc. middle Sierra Nevada; *Brodiaea scabra* Baker, Gard. Chron. ser. 3. 20:459 (1896). *Calliprora scabra* var. *anilina* Greene, l.c., type loc. middle Sierra Nevada. *C. anilina* Heller, Muhl. 2:14 (1905); cf. Muhl. 5:91 (1909). Var. LUGENS Jepson, Fl. W. Mid. Cal. ed. 2, 101 (1911).

Tritelia lugens Greene, Bull. Cal. Acad. 2:142 (1886), type loc. Vaca Mts., *Greene*. *Hookera ixioides* var. *lugens* Jepson, l.c. ed. 1, 117 (1901).

7. **B. hyacinthina** Baker. WHITE BRODIAEA. (Fig. 49f, g.) Scape 1 to $1\frac{3}{4}$ feet high; umbel 10 to 40-flowered; pedicels $\frac{1}{2}$ to 2 inches long; perianth open-campanulate, cleft below the middle, white or bluish white with green midveins, 5 to 7 lines long; filaments with broadly triangular and slightly united bases, attenuate above and tipped with an anther $\frac{1}{2}$ line long; ovary short-stipitate, with 3 glandular pits towards the summit.

Common in low moist places: Sierra Nevada, Sacramento and San Joaquin valleys, and Coast Ranges from Monterey Co. to Siskiyou Co. North to Vancouver Island.

Biol. Note. The bulb of this species is very distinctive; it has many coats which, if peeled off, leave a solid center the size of a pea. There are three forms, (*a*) large wet land form, white-flowered, the bulb large, with offsets, (*b*) var. lilacina Jepson, flowers lilac, otherwise the same as (*a*), (*c*) small dry land form, the bulb without offsets.—Carl Purdy.

Locs.—Sierra Nevada: Fort Bidwell, *Manning* 167; Plumas Co., *R. H. Platt;* Bear Valley, Nevada Co., *Jepson;* Placer Co., *Carpenter;* Tahoe, *Jepson* 7733; Gwin Mine, Calaveras Co., *Jepson* 1794; Chinese Camp, *Jepson* 6331; Kaweah River, *Hopping* 28. Coast Ranges: Eureka, *Tracy* 1160; Shasta Valley, *Butler* 1415; Sisson, *Jepson*; Middle Creek Sta., Shasta Co., *Heller* 7911; Crane Creek, w. Tehama Co., *Jepson*; Sweeney Creek, nw. Solano Co., *Jepson* 8256; Vacaville, *Jepson*; Pajaro hills, *Chandler*; Milpitas Ranch, Monterey Co., *Hall* 9980.

Refs.—BRODIAEA HYACINTHINA Baker, Gard. Chron. ser. 3, 20:459 (1896). *Hesperoscordum hyacinthinum* Lindl. Bot. Reg. sub. t. 1293 (1829), type from the "North-west Coast," *Douglas*. *Tritelia hyacinthina* Greene, Bull. Cal. Acad. 2:142 (1886). *Hookera hyacinthina* Ktze. Rev. Gen. 2:712 (1891). *H. lewisii* Hook. Fl. Bor. Am. 2:185, t. 198 A (1839). *Hesperoscordum lacteum* Lindl. Bot. Reg. t. 1639 (1833), type from Cal., *Douglas*. *Brodiaea lactea* Wats. Proc. Am. Acad. 14:238 (1879). *Brodiaea hyacinthina* var. *lactea* Baker, Gard. Chron. ser. 3, 20:459 (1896); Jepson Fl. W. Mid. Cal. ed. 2, 102 (1911). *Hookera hyachinthina* var. *lactea* Jepson, l.c. ed. 1, 118 (1901). Var. LILACINA Jepson. *B. lactea* var. *lilacina* Wats. l.c. 239, based on stout plants with large flowers turning more or less to lilac, from Mendocino and Humboldt cos. *Tritelia lilacina* Greene, Bull. Cal. Acad. 2:143 (1886), type loc. Amador Co., *Curran* (there is no material of this in the University of California Herbarium). *Brodiaea lilacina* Baker, l.c.

8. **B. terrestris** Kell. Scape very short, scarcely rising above the surface of the ground, or altogether subterranean; umbel 2 to 10 (or 20)-flowered, its pedicels slender, 3 to 8 inches long; perianth purple, 8 to 10 lines long, the limb rotate; anthers slightly longer than the filaments and shorter than the staminodia, these yellowish, erect, emarginate and with revolute edges.

Often in sandy soil, San Diego Co. to Humboldt Co., and near the coast, especially northward.

Locs.—Julian, *T. Brandegee*; Paso Robles, *Barber*; Jolon, *Brewer* 560; Del Monte, *Heller* 6773; Crystal Springs Lake, *C. F. Baker* 462; Napa Junction, *Sonne*; Del Mar, Sonoma Co., *Kennedy*; mouth of Big River, *Davy* 6580; Ft. Bragg, *W. C. Mathews* 182; Usal, *Jepson* 2209; Eureka, *Tracy* 1159.

Refs.—BRODIAEA TERRESTRIS Kell. Proc. Cal. Acad. 2:6 (1863), type loc. S. S. Bay region. *Hookera terrestris* Greene, Man. Bay Reg. 318 (1894).

9. **B. minor** Wats. Scape 4 to 10 inches high; umbels 4 to 10-flowered, the pedicels $\frac{3}{4}$ to 1 inch long, tending to spread horizontally after anthesis; perianth-segments narrow (1 to $1\frac{1}{2}$ lines broad), nearly twice as long as the tube, the throat constricted or very narrow above the ovary; staminodia purple, exceeding or equaling the stamens, 3-toothed at apex; anthers shortly cleft at apex.

Northern Sierra Nevada from Butte Co. to Eldorado Co.

Locs.—Prattville, Plumas Co., *A. L. Coombs*; Sutton House, Butte Co., *R. M. Austin*; Bear Valley, Nevada Co., *Jepson*; Colma, Eldorado Co., *K. Brandegee*; Pleasant Valley near Placerville, acc. Purdy.

Refs.—BRODIAEA MINOR Wats. Proc. Am. Acad. 14:236 (1879). *B. grandiflora* var. *minor* Benth. Pl. Hartw. 340 (1857), type loc. n. Sierra Nevada foothills, *Hartweg* 302. Watson had before him Hartweg's 302 and this we take as the type. It is not the B. minor of California botanists but is *Brodiaea purdyi* Eastw. Proc. Cal. Acad. ser. 2, 6:427, pl. 58 (1896), type loc. Colfax, *Purdy*. *Hookera purdyi* Heller, Muhl. 6:83 (1910).

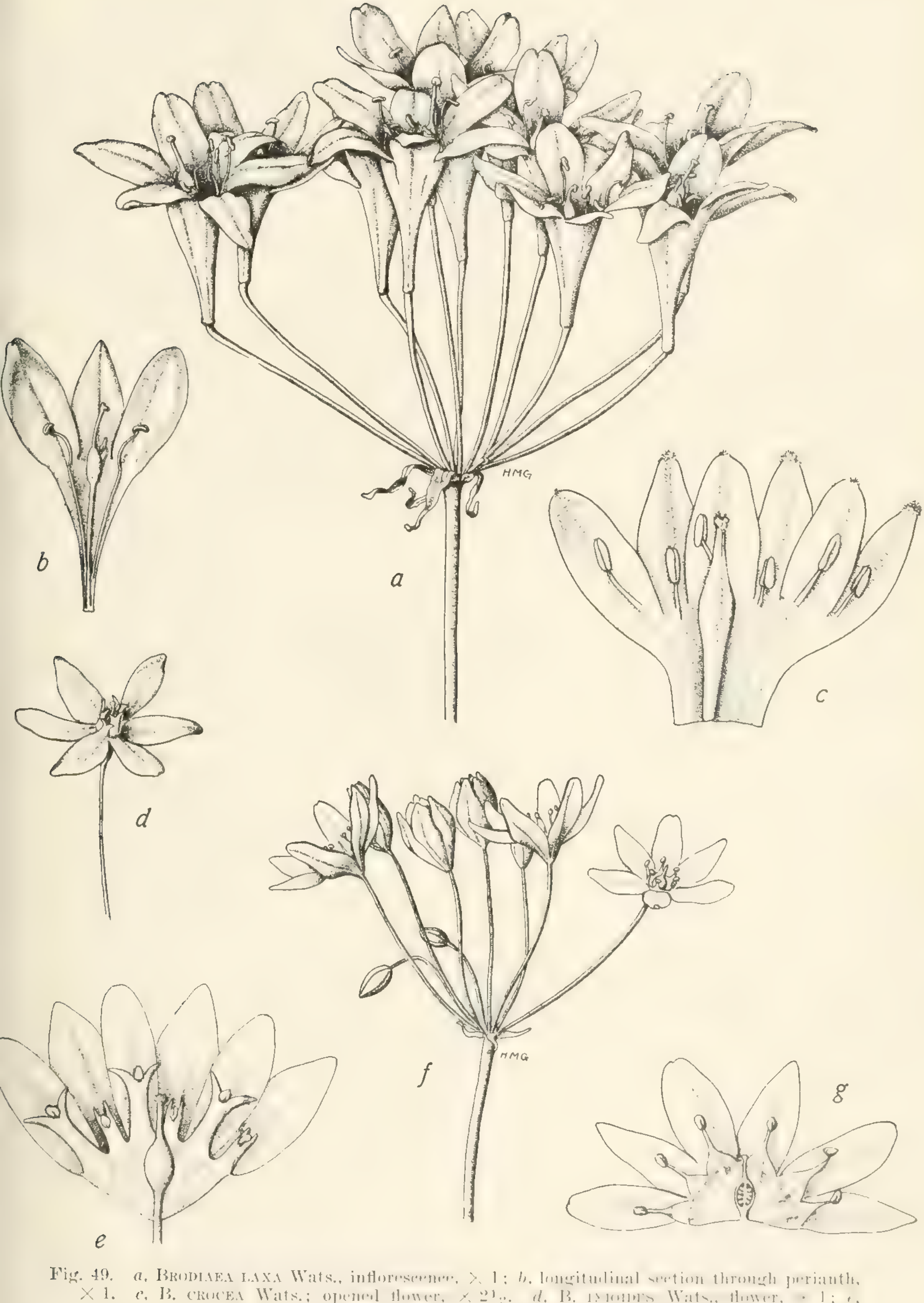

Fig. 49. *a*, Brodiaea laxa Wats., inflorescence, × 1; *b*, longitudinal section through perianth, × 1. *c*, B. crocea Wats.; opened flower, × 2½. *d*, B. ixioides Wats., flower, × 1; *e*, opened flower, × 2. *f*, B. hyacinthina Baker, inflorescence, × 1; *g*, opened flower, × 2.

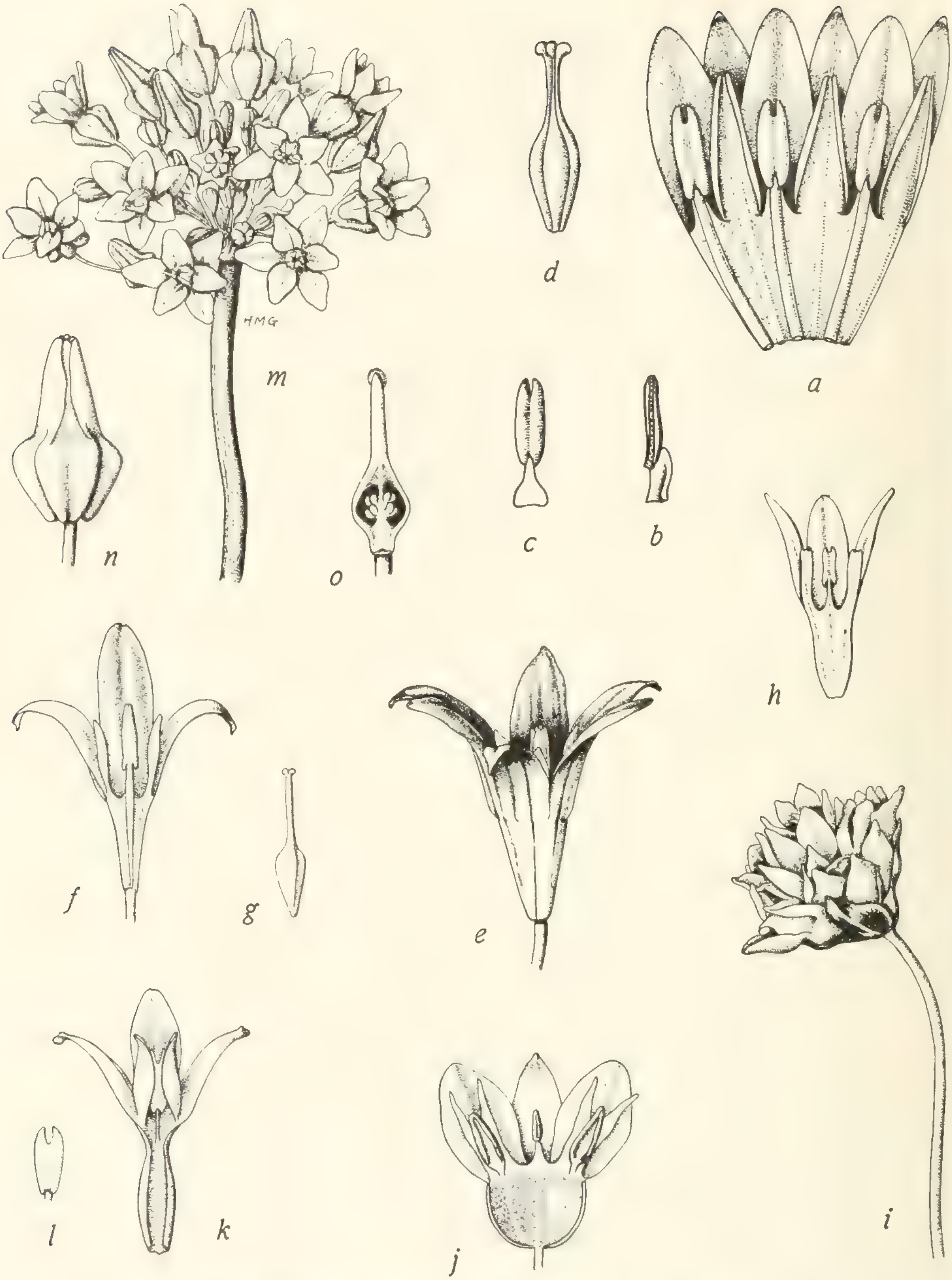

Fig. 50. *a*, BRODIAEA ROSEA Baker, inside of flower; × 2; *b*, stamen (side view), × 2; *c*, stamen (dorsal view), × 2; *d*, pistil, × 2. *e*, B. CORONARIA Jepson, flower, × 1; *f*, longitudinal section through perianth, × 1; *g*, pistil, × 1. *h*, B. SYNANDRA Jepson, longitudinal section through perianth, × 1. *i*, B. CAPITATA Benth., inflorescence, × 1; *j*, longitudinal section through perianth, × 2. *k*, B. PULCHELLA Greene, longitudinal section through perianth, × 2; *l*, anther, × 2. *m*, B. VOLUBILIS Baker, inflorescence, × 1; *n*, flower-bud, × 2; *o*, longitudinal section through pistil, × 2.

10. **B. stellaris** Wats. Scape very short (2 to 6 inches high) and pedicels long (1½ to 4 inches); corm flat, without offsets; umbel 3 to 6-flowered; perianth 6 to 9 lines long, the greenish narrow tube nearly equaling the deep-purple rather narrow segments; anthers subsessile, the short filaments bearing two appendages or linear-oblong wings standing directly behind and ½ to ⅔ as long as the anthers; anthers 1½ lines long, shorter than the staminodia; staminodia large, conspicuously white, retuse, apparently erect and not approximate around the style.

Mendocino Range; occurs longitudinally for about 20 miles (Carl Purdy).

Refs. BRODIAEA STELLARIS Wats. Proc. Am. Acad. 17:381 (1882), type loc. Gould's Ranch in the mountains sw. of Ukiah, *Purdy*. *Hookeria stellaris* Greene, Bull. Cal. Acad. 2:137 (1886). A distinctive species with strong technical characters re-collected only near Orr's Sprs., *Bergfried*.

11. **B. rosea** Baker. (Fig. 50a-d.) Scape slender, 3 to 5 inches high; bulb depressed ovate with heavily fibrous coat, 6 to 12 lines broad; umbel 3 to 10-flowered, its pedicels ½ to 1 inch long; perianth 10 lines long, flesh pink (becoming rose-pink in age or in drying), the midveins darker; perianth-segments oblong-ovate, acute; filaments narrow but backed by a deltoid-dilated wing; anthers hugging the style, deeply and narrowly notched both at base and apex; staminodia long-oblong, notched at the acutish apex, exceeding the anthers and closely approximate about them by their strongly involute margins.

Northeastern Lake Co., on the serpentine rocks.

Locs.—Indian Valley, ne. Lake Co., *Jepson* 8985; Epperson Mt., acc. Purdy.

Refs.—BLODIAEA ROSEA Baker, Gard. Chron. ser. 3, 20:214, fig. 39 (1896). *Hookera rosea* Greene, Bull. Cal. Acad. 2:137 (1886), type loc., Hough's Springs, Lake Co., *Curran*.

12. **B. coronaria** Jepson. HARVEST BRODIAEA. (Fig. 50e-g.) Scape stout, (5 or) 7 to 20 inches high; umbel 3 to 11-flowered, its pedicels 1 to 3½ inches long; perianth violet-purple, 1¼ to 1¾ inches long; segments narrowly oblong, longer than the tube, in age withering and becoming caudate; anthers 4 to 5 lines long, exceeding or at least equaling the oblong-lanceolate mostly acute staminodia; staminodia erect, the anthers approximate in center around style; ovary with strongly developed angles or shoulders.

Common on rolling plains, in the foothills and mountains, Coast Ranges and Sierra Nevada foothills, Sacramento and San Joaquin valleys, south to cismontane Southern California; north to Vancouver Island; flowering in May and early June at the time of the hay harvest when the hills and fields are turning brown. Altitude 200 to 2500 feet, or up to 4500, or even 8000 feet towards the south. Rarely occurs near the coast.

Locs.—Sierra Nevada: Iron Cañon, Butte Co., *R. M. Austin* 27; Grass Valley, *Heller* 8097; Bear Valley, Nevada Co., *Jepson*; Ione, *Braunton* 1009; Clements, *Jepson* 1822; Columbia, *Jepson* 6395; Confidence, *Jepson* 7712; Strawberry, Tuolumne Co., *Elizabeth Perra*; Tenaya Creek, *Jepson* 4386; Hetch Hetchy, *Jepson* 3474, 4623; Coulterville grade, *Jepson*; Huntington Lake, Fresno Co., *A. L. Grant* 1092; Mineral King, *Jepson* 1153. San Joaquin Valley: Collis, *Jepson* 2744. Southern California: San Bernardino Mts., *Parish* 1660. Coast Ranges: Yreka, *Butler* 1421; Redwood Creek, Hupa road, *Jepson* 1960; Bear Valley, w. Colusa Co., *Jepson* 8971; Mendocino Range, *Jepson* 7628; Windsor, *Jepson* 7655; Mt. St. Helena, *Jepson* 7665; Howell Mt. foothills, *Jepson* 2434; Sweeney Creek, nw. Solano Co., *Jepson* 9053; Vacaville, *Jepson* 4237; Napa, *Jepson*; Sonoma Creek Cañon, *M. S. Baker*; Benicia Hills, *Jepson* 8324; Berkeley, *Helen Bergfried*; Mt. Diablo, *Jepson* 7599; Niles, *Jepson*; Madrona, Santa Clara Co., *Jepson*; Mt. Hamilton, *Holden*; Jolon, *K. Brandegee*.

Var. **mundula** Jepson n. var. Fifteen to 18 inches high; pedicels 3 to 6 or 8 lines long.—(Plantae unc. 15-18 altae; umbella compacta; pediculi lin. 3–6 vel 8 longi.)—Soulsbyville, Tuolumne Co., *Jepson* 7683 (type). A trim tall plant with very compact umbels.

Refs.—BRODIAEA CORONARIA Jepson, Madroño, 1:61 (1917). *Hookera coronaria* Salisb. Parad. t. 98 (1806), type loc. Cal., first collected by *Menzies*; Britten, Jour. Bot. 24:51 (1886); Greene, Bull. Cal. Acad. 2:136 (1886); Jepson, Fl. W. Mid. Cal. 116 (1901). *Brodiaea grandiflora* Smith, Trans. Linn. Soc. 10:2 (1811), type from Vancouver Isl., *Menzies*; Lindl.

Bot. Reg. t. 1183 (1828); Wats. Bot. Cal. 2:153 (1880); Jepson, l.c. ed. 2, 100 (1911). Var. MUNDULA Jepson.

13. **B. filifolia** Wats. Scape 4 to 12 inches high, rather slender, especially when several arise from 1 corm; perianth dark blue, segments rotate; anthers sessile, nearly twice as long as the scale-like triangular narrowly acuminate staminodia.

San Bernardino Valley and foothills.

Locs.—San Bernardino, *Parish* 3669; Arrowhead Hot Sprs., *Parish*.

Var. **orcuttii** Jepson n. comb. Perianth violet to rose purple; anthers generally longer than the filaments; staminodia absent, or very short, triangular and mostly adnate.—San Diego Co.: San Diego, *T. Brandegee*; Santa Isabel, *Parish* 4413.

Refs.—BRODIAEA FILIFOLIA Wats. Proc. Am. Acad. 17:381 (1882), type loc. San Bernardino, *S. B. & W. F. Parish*. *Hookera filifolia* Greene, Bull. Cal. Acad. 2:138 (1886). Var. ORCUTTII Jepson. *Hookera orcuttii* Greene, l.c., type loc. San Diego, *Orcutt*. *Brodiaea orcuttii* Baker, l.c. fig. 40. *Hookera multipedunculata* Abrams, Bull. Torr. Bot. Club 32:537 (1905), type loc. Cuyamaca Lake, *Abrams* 3897.

14. **B. synandra** Jepson n. comb. (Fig. 50h.) Scape slender, 3 to 8 inches high; umbel 2 to 5-flowered; its pedicels 1 to 2½ inches long; perianth blue, 7 to 12 lines long, its tube oblong or even slightly inflated, 4 to 5 lines long, the segments 1 to 2 lines longer, rotately spreading or often strongly recurved, each with a mid-vein, green on back and running down to base of perianth; anthers 2 to 2½ lines long, close around the style; staminodia broadly ligulate or with somewhat involute margins, commonly 3-toothed at apex, usually closely covering the anthers and closing the throat; ovary with weakly developed shoulders.

Dry adobe or clay soil, often on gravelly or alkaline plains and low hills, Sacramento and San Joaquin valleys, Sierra Nevada foothills and Coast Ranges, south to cismontane Southern California and north to Oregon. Altitude 200 to 2500 feet, sometimes occurring up to 3500 or 7000 feet, especially southward. Not reported from Humboldt and Mendocino cos. The anthers have an open or U-shaped notch at apex; in B. coronaria the anthers are merely cleft at apex.

Tax. Note.—This widely distributed species is the B. minor of Cal. authors and of Wats. in part. It is entirely distinct from the original B. minor Wats. (*B. purdyi* Eastw.), which is restricted to the northern Sierra Nevada. The first available name for the former species is Hookera synandra Heller, the diagnosis of which answers well to B. minor of Cal. authors, especially as to the anthers and position of staminodia. We have not, however, seen Heller's type, nor were we able to collect topotypes when visiting the type locality.

Locs.—Oro Fino, Siskiyou Co., *Butler* 891; Modoc Co., *M. S. Baker*; Stevens, Shasta Co., *M. S. Baker* 358; Santa Rosa, *K. Brandegee* (filaments deltoid-dilated); Vacaville, *Jepson* 4238; Milton, *Davy* 1346; Tollhouse, Fresno Co., *Hall & Chandler* 22; San Miguelito Rancho, Jolon, *Jepson* 1645; Little Green Valley, San Bernardino Mts., *G. R. Hall* 23; Strawberry Valley, Mt. San Jacinto, *Hall* 2093; Santa Ana Mts., *Alice King*; San Diego, *Dunn*; Laguna Mts., San Diego Co., *T. Brandegee*.

Var. **insignis** Jepson n. var. Staminodia straw-color or whitish, ovate-lanceolate, 3½ to 4 lines long, longer than the stamens, and as long as the perianth-tube.—(Staminodia ovato-lanceolata, straminea vel albida, lin. 3½-4 longa, stamina superantia, aeque longa ac tubus perianthii.)—Shepherd Cove, Sequoia Park, *Walter Fry* (type).

Refs.—BRODIAEA SYNANDRA Jepson. *Hookera synandra* Heller, Bull. S. Cal. Acad. 2:65 (1903), type loc. Petrified Forest, Sonoma Co., *Heller* 5742. *H. minor* Greene, Man. Bay Reg. 318 (1894); Jepson, Fl. W. Mid. Cal. 115 (1901). *Brodiaea minor* Jepson l.c. ed. 2, 100 (1911); Wats. Bot. Cal. 2:153 (1880), in part. Var. INSIGNIS Jepson.

15. **B. californica** Lindl. Slender, 4 to 12 inches high; umbels 2 to 4-flowered (sometimes as few as 1 or as many as 12-flowered); perianth violet-purple, 1 to 1½ inches long, the tube ⅓ as long; band on back of segments yellowish-green; anthers long, approximate in center on filaments as long, and closely invested by the staminodia; staminodia white, involute, obtuse, shortly cleft, very slightly surpassing the anthers, commonly both very long, nearly as long as the perianth.

Alkaline flats: Sonoma and Napa cos.; Sacramento Valley (no exact station known).

Locs.—In June 1918 Brodiaea californica was found on Poor Man's Flat near Windsor, Sonoma Co. (*Jepson* 7654, 7621), a rolling clay plain thinly covered with Quercus douglasii. The plants grew in moist swales, a few scattered individuals also occurring on the dry flats. The perianth-segments were erect, the staminodia (quite to their tips) wholly and closely investing the anthers. Saving for these somewhat immaterial points the Windsor specimens represent B. californica Lindl., since they agree so well with the original diagnosis and figure. The Windsor plants also undoubtedly represent, and are probably typical of, *Hookera leptandra* Greene which we have not been able thus far to rediscover at Calistoga, the type locality (although possibly it may have been exterminated by cultivation). A few specimens of the plants from Windsor, at once recognized as representing a clearly distinct species, were distributed as Brodiaea leptandra Jepson, before their identity with B. californica was determined.

While B. californica may well have been re-collected in the Sacramento Valley since Hartweg obtained the type specimen in 1845, we have no records to that effect. It would rather seem from the internal evidence that Greene had no specimens of this species before him when writing his diagnosis of Hookera californica in "Genera Confused under Brodiaea" (Bull. Cal. Acad. 2:136, 1889), a suggestion that is strengthened by the fact that he published the species later as new under the name Hookera leptandra.

Refs.—BRODIAEA CALIFORNICA Lindl. Jour. Hort. Soc. Lond. 4:84, fig. (1849), type loc. nw. Butte Co. (probably near the present settlement of Caña), *Hartweg* 326; cf. Hartweg, Jour. Hort. Soc. Lond. 3:221. *Hookera leptandra* Greene, Pitt. 1:74 (1887), type loc. Calistoga, *Parry*.

16. **B. capitata** Benth. BLUE DICKS. (Fig. 50i, j.) Scape erect, $\frac{1}{2}$ to $1\frac{1}{4}$ (or 2) feet high, ending in a head-like umbel of 4 to 10 flowers, with about 4 dark purple or metallic bracts; flowers blue, 5 to 8 lines long; perianth-segments elliptic-ovate, obtuse, a little longer than the tube; stamens with anthers 6; filaments opposite the inner perianth-segments with a broad membranous wing extended beyond the anthers as two lanceolate appendages; stamens opposite outer perianth-segments with filaments dilated toward the base only, their anthers less than $\frac{1}{2}$ the size of those of the other set; appendages convergent or connivent, forming a corona and more or less concealing the anthers.

Very common on hillsides and plains through the Coast Ranges, Great Valley, Sierra Nevada foothills and Southern California. Not in the higher mountains, and rare in or absent from the deserts. Southern Oregon, Arizona, Lower California.

In height, size of heads and shade of blue, it is variable, but the variations are of slight taxonomic importance. "Next to Eschscholtzia, Brodiaea capitata is the universal flower of the State."—Edw. R. Barnard, Chancellor of Salisbury Cathedral, England. Also called Cluster Lily and Spanish Lily, Wild Hyacinth (San Bernardino), Nigger-toes (Tulare Co.), Indian Lily and Nigger-babies (Alameda Co.), Sugar-lump (Sonoma Co.), Pigtails and Indian Head (Lake Co.), and Coquinito (Tuhunga).

Biol. Note.—In this species there are three different modes of corm reproduction or rejuvenation. A new corm regularly develops on top of the old corm at the base of the scape, and replaces the old corm which gradually becomes reduced to a thin fibrous layer (this habit probably occurs in other species of the section or genus). From the base of the corm bulblets are produced in considerable numbers on rather short slender offsets. Further, a corm early in the season (Feb.) often produces beneath, vertically or laterally, a fleshy fusiform structure which gives rise to a new and thus more deeply seated corm.

Locs.—Yreka, *Butler*; Kneeland Prairie, *Tracy* 2674; Buck Mt. (base to the summit, 5500 ft.), *Tracy;* Calistoga, *Jepson;* St. Helena, *Jepson;* Vacaville, *Jepson* 5302; Mt. Tamalpais, *Jepson* 7560; Berkeley, *Jepson*; Monterey and Jolon acc. Eastwood; Pine Ridge, Fresno Co., *Hall & Chandler* 99; Lloyd Mdw., Kern River, *Jepson* 4894; Rowen, Tehachapi Range, *Jepson* 6728; Panamint Mts., *Jepson* 6989; Manzana, Antelope Valley, *Davy*; Santa Monica, *Barber;* Arroyo Seco, *Peirson* 7; Mt. San Jacinto, *Jepson* 1299a; Santa Ana, *Alice King;* La Mesa, San Diego Co., *Jepson* 6685.

Refs.—BRODIAEA CAPITATA Benth. Pl. Hartweg. 339 (1857), type loc., woods near Monterey, *Hartweg* 58; Cov. Contrib. U. S. Nat. Herb. 4:203 (1893); Jepson, Fl. W. Mid. Cal. ed. 2, 101 (1911). *Hookera capitata* Ktze. Rev. Gen. 2:712 (1891); Jepson, l.c. ed. 1, 117 (1901). *Dipterostemon capitatus* Rydb. Bull. Torr. Club, 39:111 (1912).

17. **B. pulchella** Greene. OOKOW. (Fig. 50k, l.) Scape 2 to $3\frac{1}{2}$ (or even 5) feet high, often flexuous; umbel appearing capitate but really short-racemose, 6 to 16-flowered, subtended by 3 to 5 ovate subacuminate bracts; flowers lavender-purple or blue-purple, 7 to 8 lines long, in a dense head; perianth-segments

spreading, oblong, shorter or longer than the tube, which is slightly constricted at apex; anthers 3, sessile; staminodia petaloid, deeply cleft, surpassing the anthers, commonly bearing a short wholly sterile filament in the notch.

Open hills in the Coast Ranges, Alameda Co. to Humboldt Co., thence easterly to Shasta Co. Far north to Washington. Common in Humboldt Co., mostly infrequent in Alameda Co. Flowers later than B. capitata.

Biol. Note.—The three anthers are very flat and converge or approximate around the style by their edges. The cleft staminode is revolute so as to form a cylinder or tube, with the cylinder open on the inside in such a way as to receive the dehiscing edges of a pair of anthers. These tubes, into which the pollen is shed, form the only entrances to the nectarial portion of the tube, so that these structures seem like insect adaptations. We have never observed insects visit this species, although they doubtless do.

Locs.—Alderney, Marin Co., *Jepson* 8277; Bolinas Road near Manzanita, *A. L. Grant* 1210; Berkeley Hills, *Jepson*; Mt. Diablo, *Jepson* 7603; Vacaville, *Jepson* 6796; St. Helena, *Jepson*; Hubbard's Sta., Humboldt Co., *Davy* 5430; Van Duzen River Valley, *Tracy* 2773; Fall River Sprs., Shasta Co., *Hall & Babcock* 4192.

Refs.—BRODIAEA PULCHELLA Greene, Bull. Cal. Acad. 2:133 (1886). *Hookera pulchella* Salisb. Parad. Lond. under pl. 98 (1806), type from Cal., *Menzies*. *Dichelostemma pulchellum* Heller, Muhl. 1:132 (1906). *Brodiaea congesta* Smith, Trans. Linn. Soc. 10:3, t. 1 (1811), type loc. Vancouver Isl., *Menzies*; Jepson, Fl. W. Mid. Cal. ed. 2, 101 (1911). *Hookera congesta* Jepson l.c. ed. 1, 116 (1901). *Dipterostemon pulchellus* Rydb. Bull. Torr. Club 39:111 (1912).

18. **B. multiflora** Benth. Scape 8 to 24 inches high, somewhat scabrous; umbel capitate, not produced, 8 to 24-flowered; flowers light purple; perianth-tube constricted upwards; staminodia entire, broad, obtuse, involute-cylindric, equaling or exceeding the anthers; stamens 3, rarely 6 in retarded flowers.

Sierra Nevada foothills, 500 to 3500 feet, Mariposa Co. north to Shasta Co., thence southerly in the Coast Ranges to Humboldt Co. Oregon. June.

Biol. Note.—The anthers converge or approximate in the center around the style. The staminodia are involute-tubular and thus make 3 cylindric passages leading down into the corolla tube, but formed in such a way as to leave a slit on the inner side; into this slit the edge of each pair of contiguous anthers project and dehisce.

Locs.—Hazel Green, Mariposa Co., *Jepson*; Crockers, Big Oak Flat road, *Jepson* 8348; Confidence, Tuolumne Co., *Jepson* 7713; Italian Bar, Tuolumne Co., *Jepson* 6387; Avery Sta., Calaveras Co., *A. L. Grant*; Blue Cañon, Placer Co., *Harriet Walker* 1276; Quincy, *Jepson* 4146; Bear Valley, Nevada Co., *Jepson*; Dixey Mts., Lassen Co., *Baker & Nutting*; Redding, *Heller* 7862; Yreka, *Butler* 1361; Chico, *R. M. Austin* 37; Rosewood, w. Tehama Co., *Jepson*; Hupa, *Chandler* 1310.

Refs.—BRODIAEA MULTIFLORA Benth. Pl. Hartw. 339 (1857), type loc. Sacramento Valley, *Hartweg* 274; Hook. Bot. Mag. t. 5989 (1872); Purdy, Zoe, 1:101 (1890). *Hookera multiflora* Britten, Jour. Bot. 24:51 (1886). *Dichelostemma multiflorum* Heller, Muhl. 2:15 (1905).

19. **B. volubilis** Baker. SNAKE LILY. TWINING BRODIAEA. (Fig. 50m-o.) Scape roughish, 2 or 3 feet high and lax, or twining over bushes and attaining a height of 7 or 8 feet; leaves 1 or 1½ to 2¼ feet long, 4 to 6 lines broad, carinate; umbel short and dense, 18 to 30-flowered; pedicels ½ to 1 inch long; perianth rose-red or pinkish, 6 to 8 lines long; tube 3 to 4 lines long and broad, 6-angled, the angles produced into sacs somewhat above the middle; segments rotate, their tips recurved; stamens 3, inserted on the throat opposite the inner segments, their filaments short, with lanceolate appendages nearly or quite as long as the anthers; staminodia 3, opposite the outer segments, ligulate, emarginate.

Mostly open-brush slopes: Sierra Nevada foothills, Butte Co. to Tulare Co., 500 to 2500 feet; inner north Coast Range.

Locs.—Sierra Nevada: Berry Cañon, se. of Chico, *Heller* 5499; Auburn, *Sonne* 12; New York Ravine, Eldorado Co., *K. Brandegee*; Vallecito, Calaveras Co., *A. L. Grant*; Columbia, *Jepson* 6345; Wawona, *Jepson* 8385; Pine Ridge, Fresno Co., *Hall & Chandler* 80; Kaweah River, *Hopping* 25. Inner North Coast Range: Gates Cañon, Vaca Mts., *Jepson* 555; Napa Valley; Zem Zem, ne. Napa Co., *Jepson* 9048; Kelseyville acc. *Eastwood.*

Refs.—BRODIAEA VOLUBILIS Baker, Jour. Linn. Soc. 11:377 (1871); Curran, Bull. Cal. Acad. 1:149 (1885); Greene, Bull. Cal. Acad. 2:130 (1886). *Macroscapa volubilis* Kell.

Pacific 3:132 (1854), type loc. Calaveras Co., *Wm. A. Davidson.* *Hookera volubilis* Jepson, Fl. W. Mid. Cal. ed. 1, 116 (1901). *Dichelostemma volubilis* Heller, Bull. S. Cal. Acad. 2:65 (1903). *Stropholirion californicum* Torr. Pac. R. Rep. 4:149, pl. 23 (1856), type loc. Knight's Ferry, *Bigelow.* *Brodiaea californica* Jepson, Fl. W. Mid. Cal. ed. 2, 101 (1911) (not Lindl.).

The final test for the acceptance of the specific name volubilis as the first designation of this species rests upon the argument that Macroscapa volubilis Kell. was adequately published, first because the "Pacific" was a legitimate medium of publication, being a weekly magazine of "religion, education and general intelligence," paged in sequence for the whole volume (and not as a newspaper paged afresh for each issue), and secondly that the species was technically characterized in full.

20. **B. ida-maia** Greene. FIRE-CRACKER PLANT. Scape slender, erect, 1 to 3 feet high, bearing an umbel 6 to 12 (or 23)-flowered, its pedicels $\frac{3}{4}$ to $1\frac{1}{2}$ inches long; flowers pendulous, erect after anthesis; leaves linear; perianth-tube scarlet, persistent, broadly tubular, slightly 6-saccate at the truncate base, slightly constricted above, 1 to $1\frac{1}{4}$ inches long; segments chrome-green, short, erect or sometimes reflexed or revolute, erect in age, 2 to 3 lines long; stamens 3, inserted on the throat opposite the inner segments, their filaments very short and broad; anthers innate; staminodia 3, white; capsule triangular-ovate, acuminate, its stipe 2 or 3 lines long; seeds angular, black.

Wooded foothills and mountain slopes from Marin Co. to Shasta and Siskiyou cos., 1000 to 4000 feet. July. A showy and curious species.

Biol. Note.—An apparent hybrid between B. ida-maia and B. pulchella was found at Buck Mt., Humboldt Co., acc. J. P. Tracy. B. ida-maia differs from most other Brodiaeas in propagating by slender offsets from the corm, and from all others in its pendulous flowers, scarlet perianth and strongly revolute perianth-segments. Plants with the flowers all yellow have been found in the hills east of Eureka by Carl Purdy.

Locs.—Elk Mt., Lake Co., *Jepson*; Comptche, *H. A. Walker* 335; Cahto, Mendocino Co., *Davy* 6615; South Fork Eel River, Lake Co., *Jepson*; Buck Mt., *Tracy* 4227; Brannan Mt., *Tracy* 3438; Three Creeks to Redwood Creek, *Jepson* 2132; Highland Mine, Siskiyou Co., *Butler* 889; between Anderson and Olinda, acc. *Alma Ames.*

Refs.—BRODIAEA IDA-MAIA Greene, Pitt. 2:250 (1892). *Brevoortia ida-maia* Wood, Proc. Acad. Phila. 20:173 (1868), type loc. Trinity Mts., Shasta Co., *Wood.* *Brevoortia coccinea* Wats. Proc. Am. Acad. 14:239 (1879); Baker, Gard. Chron. 20:687, fig. 118 (1896). *Dichelostemma ida-maia* Greene, Man. Bay Reg. 318 (1894).

21. **B. venusta** Jepson n. comb. Similar to B. ida-maia but the perianth rose-purple, constricted under the segments; staminodia pinkish, longer than the anthers.

Mendocino Range. Little known; in great need of further study.

Loc.—Near Orrs Hot Sprs., *Helen Bergfried.*

Refs.—BRODIAEA VENUSTA Jepson. *Brevoortia venusta* Greene, Pitt. 2:230 (1892), described from a cultivated plant, its geographic origin unknown. Mr. Carl Purdy considers it to be a hybrid between B. ida-maia and B. congesta (cf. Pitt. 2:249). It is to be inferred from his note that it also occurs near Cahto.

Bessera Schult. Scape from a tunicated bulb and bearing a few-flowered umbel. Stamens 6, inserted on the throat of the 6-cleft perianth, the filaments united above the middle into a tube with erect bifid lobes alternate with the anthers. Style 1. Capsule 3-angled. B. BREVIFLORA Jepson n. comb. (*Androstephium breviflorum* Wats. Am. Nat. 7:303 (1873), type loc. s. Utah, *Thompson*). Flowers light purple.—Fort Mohave, Arizona, *Cooper*, and therefore to be expected within our limits.

17. **CALOCHORTUS** Pursh. MARIPOSA LILY

Stem from a membranous-coated corm. Leaves narrow, the basal solitary or rarely 2, the cauline few. Flowers showy, white, yellow, lilac or bluish, borne terminally on the stem or branches or in an umbellate fascicle. Perianth deciduous, the segments distinct and often concave. Sepals lanceolate, greenish or colored. Petals for the most part broadly cuneate-obovate and usually bearing near the base a conspicuous gland, either on the surface or depressed in an excavation or pocket. Stamens 6, on the base of the segments. Ovary triquetrous; stigmas sessile, recurved, persistent. Capsule elliptical or oblong, membranaceous, 3-angled or winged, commonly septicidally dehiscent. Seeds numerous, in 2 rows in each cell, somewhat flattened.—West American genus of about 35 species, in California occurring in all mountain ranges, but absent from the Colorado Desert, and mainly or wholly absent from lower altitudes in the Mohave Desert and mainly absent from the floor-like plains of the Sacramento and San Joaquin valleys, i.e., occurring only in restricted localities. (Greek kalos, beautiful, and chortos, grass, in allusion to the flowers and grass-like leaves.)

Bibliog.—Douglas, D., An Account of the Species of Calochortus (Trans. Hort. Soc. Lond. 7:275–280,—1830). Davidson, A., Cal. Field Notes: Calochortus (Eryth. 2:1–2, 27–30,—1894). Parish, S. B., Variations of Calochortus venustus (Zoe, 3:352-354,—1892); The S. Cal. Species of Calochortus (Bull. S. Cal. Acad. 1:102-106, 120–125,—1902). Hansen, Geo., Probable Hybridization in Calochortus (Erythea 2:52,—1894); Calochorti in the Sierra Nevada (l.c. 7:13–15,—1899). Purdy, C., Revision of the Genus Calochortus (Proc. Cal. Acad. ser. 3, 2:107–149, pls. 15–19,—1901). Piper, C. V., Notes on Calochortus (Bull. Torr. Bot. Club, 33:537-540,—1906). Masters, M. T., Calochortus pulchellus (Gard. Chron. 34:133-4, figs. 52, 53,—1903).

A. Flowers open-campanulate, these and the capsules erect; sepals ovate-lanceolate; petals 1 to 2 inches long; capsule ovoid-attenuate, or oblong to linear.

1. *Gland surface densely hairy; basal leaves 1 or 2 to 4, linear, channeled, shorter than the stem (except in occasional dwarfs of nos. 3, 8 and 12).*

a. Gland not depressed, without membrane or scales.

Hairs of gland linear, entire.
  Capsule ovoid-attenuate or oblong; gland oval, surrounded or surmounted by a dark blotch.
    Capsule oblong, obtuse, flowers cream to lilac; gland surrounded by a dark purplish maroon blotch........1. *C. catalinae.*
    Capsule ovoid, attenuate.
      Stems sinuous, often straggling over the ground........2. *C. flexuosus.*
      Stems straight or straightish, erect.
        Flowers lilac or purplish to white, reddish brown about the gland....3. *C. palmeri.*
        Flowers white or bluish-purple tinged, the petals yellow at base, a purple spot above the gland........4. *C. leichtlinii.*
  Capsule ovoid-linear or linear; petals ornately penciled or blotched; gland shape varying, oval, transverse oblong, lunate or doubly lunate.
    Flowers yellow, rarely white; gland transverse, lunate, broadly linear or oblong........5. *C. luteus.*
    Flowers creamy white to purple, rarely yellow; petals usually oculated; gland oval, roundish or quadrate........6. *C. venustus.*
Hairs of the gland with swollen and knobbed or fungoid-stellate tips; gland circular, oval or irregularly fan-shaped; sepals broadly scarious-margined; capsule linear, dense-walled.
  Gland oval with definite outline or absent, its hairs with swollen stellate tips 7. *C. splendens.*
  Gland spreading with irregular outline, its hairs broadly clavate, knobbed....8. *C. invenustus.*

b. Gland depressed, surrounded by a more or less continuous laciniate membrane; capsule linear, dense-walled.

Gland not circular.
  Gland oval, its membrane generally not continuous; petals dingy white to lurid purple, not persistent........9. *C. nuttallii.*
  Gland obcordate, its membrane continuous; petals purple-lilac, persistent until maturity of fruit........10. *C. macrocarpus.*
Gland circular, its membrane continuous.
  Flowers yellow; stems tall.
    Anthers reddish brown; petal hairs clavate........11. *C. clavatus.*
    Anthers yellow; petal hairs slender........12. *C. concolor.*
  Flowers vermilion; stem very low........13. *C. kennedyi.*

2. *Gland surface naked or with a few scattered hairs; gland circular to oblong, depressed in a pocket, bearing a dense border of linear hairs; hairs of the petals arising from a small dark spot, and of a different or darker hue than the main petal color; corm thickly covered with several coats of dark brown fibres; basal leaf one, broadly lanceolate-acuminate; cauline leaves broad, acuminate.*

Flowers orange-color to lemon-yellow; petals fringed or serrate.
  Petals broadly fan-shaped, the margins fringed or serrate......14. *C. weedii.*
  Petals ovate, generally black-tipped, much shorter than the sepals, the margins long fringed. 15. *C. obispoensis.*
Flowers lilac or lilac-purple; petals neither fringed nor serrate......16. *C. plummerae.*

B. Flowers closed-campanulate (or subglobose); flowers and capsules nodding; petals strongly incurved or arched, the gland deeply pocketed and transversely crested or bearded; basal leaf solitary.

Petals yellow, the margins fimbriate; gland pocket hidden by long hairs borne in 2 or 3 more or less regular rows on the upper fold of the pocket......17. *C. pulchellus.*
Petals white to pale pink or rose, the margins entire; gland lunate, pocketed, with 4 transverse imbricate scales......18. *C. albus.*

C. Flowers campanulate, erect or ascending, the capsules usually nodding; gland shallow to moderately pocketed, covered from below by a narrow fringed scale and crested above (except in C. nudus) by short hairs or scales; claw of petal below the scale often more or less glandular; basal leaf solitary, conspicuously long, surpassing the inflorescence.

Petals obovate, mostly acute, hairy all over; gland proper (excluding the more or less glandular claw of petal below the scale) from moderately curved or lunate to horseshoe-shaped, but always concave on its lower margin; anthers lanceolate-acute.
  Petals yellow, or brownish, the hairs all yellow......19. *C. monophyllus.*
  Petals white to purplish blue, the hairs on lower half usually blue, on upper half white...... 20. *C. caeruleus.*
Petals fan- or wedge shaped, truncatish or rounded, naked, or hairy only near the gland; gland proper straight or nearly so in no. 21, in nos. 22 to 24 saucer-shaped to bowl-shaped in outline and always convex on the lower margin; anthers linear to oblong (or narrowly eliptic), acute or obtuse.
  Petals white; capsules nodding.
    Petals naked; anthers linear; Sierra Nevada......21. *C. nudus.*
    Petals hairy about the gland; anthers short oblong; Bay region......22. *C. umbellatus.*
  Petals lilac.
    Petals finely denticulate, hairy on lower third; capsules nodding......23. *C. uniflorus.*
    Petals entire, a very few scattered hairs above the gland; capsules usually erect...... 24. *C. greenei.*

1. **C. catalinae** Wats. Stem commonly branched, 1 to 2 feet high; sepals green, shorter than the petals; petals cuneate, longer than wide, rounded at summit, white tinged with lilac, or lilac or light purple, a large ovate purplish maroon spot at base surrounding the gland; gland oblong, covered with dark hairs; anthers obtuse, pinkish, shorter than the filaments; capsule oblong, obtuse, 1 to 2 inches long, 4 to 5 lines wide; seeds very numerous, white, thin, minutely pitted, 2 lines in diameter.

Coast of Southern California, local from Santa Barbara Co. to Los Angeles Co., and common on the Santa Barbara Islands. Very constant in coloration.

Locs.—Santa Inez Mts., acc. Abrams; Santa Paula, *Cobb* 134; Santa Monica Mts., *Hall* 3263; Casitas Pass, *Hall* 3137; Glendora, *Braunton* 268; Avalon, *Trask*.

Refs.—CALOCHORTUS CATALINAE Wats. Proc. Am. Acad. 14:268 (1879), type loc. Santa Catalina Isl., *Schumacher*; Davidson, Erythea, 2:2 (1894). *C. lyonii* Wats. l.c. 21:455 (1886).

2. **C. flexuosus** Wats. Stem slender, remarkably sinuous, weak, commonly straggling over the ground; sepals greenish with a deep purple spot; petals with numerous striae, truncatish at apex, deep purple (rarely white), with variable bands or spots; gland and its hairs like C. palmeri.

Death Valley region. East through southern Nevada to southern Utah.

Locs.—Argus Mts., acc. Jones in litt. Bighorn Cañon, Grapevine Mts., Nev. (near Cal. line), *Coville & Funston* 978.

Refs.—CALOCHORTUS FLEXUOSUS Wats. Am. Nat. 7:303 (1873), type loc. s. Utah, *Thompson*; Cov., Contrib. U. S. Nat. Herb. 4:204 (1893). *C. comosus* Nelson, Bot. Gaz., 47:425 (1909), type loc. Las Vegas, Nev., *Gooding* 2323.

3. **C. palmeri** Wats. (Fig. 51a.) Stems 4 to 12 inches high, slightly branched, not bulbiferous at base; sepals purplish-striated, oblong, acuminate, the tip recurving; petals broadly cuneate, rounded at apex, sometimes apiculate, purple, purple-striated, reddish-brown about the gland, sparsely white-hairy except on upper part; gland oval to oblong, densely tufted; hairs a little 4-sided, and narrowly winged at the angles; anthers oblong, obtuse.

Local in moist alkaline spots: borders of the Mohave Desert near the bases of the San Gabriel and San Bernardino mountains. May.

Locs.—Twenty nine Palms, *T. Brandegee*; Rabbit Springs, *Jepson* 5940; Lancaster, *K. Brandegee.*

Var. **paludicolus** Jepson & Ames n. comb. Sepals yellowish inside with conspicuous oblong brown spots; petals rose to pale pink.—Meadows, Bear Valley, San Bernardino Mts., 6500 feet.

Var. **dunnii** Jepson & Ames n. comb. Stems 1 to 2 feet high; sepals with white-scarious margins, sometimes with a black or reddish-brown blotch near the base; petals white with a brown transverse band crowning the gland.—Local in the interior arid mountains of San Diego Co.: Julian, acc. Purdy; Descanso, *T. Brandegee.*

Refs.—CALOCHORTUS PALMERI Wats. Proc. Am. Acad. 14:266 (1879), type coll. by Palmer (no. 527) at the head of the Mohave River, probably at Los Flores Rancho acc. Parish, Bull. S. Cal. Acad. 1:122 (1902). *C. striatus* Parish, l.c. type loc. Rabbit Sprs., Mohave Desert, *Parish.* Var. PALUDICOLUS Jepson & Ames. *C. paludicola* Davidson, Bull. S. Cal. Acad. 9:53 (1910), type loc. Bear Valley, San Bernardino Mts., *Davidson* 2171. Var. DUNNII Jepson & Ames. *C. dunnii* Purdy, Proc. Cal. Acad. ser. 3, 2:147 (1901), type loc. Julian, San Diego Co., *G. W. Dunn.*

4. **C. leichtlinii** Hook. (Fig. 51b-d.) Stem erect, varying from 2 inches to nearly 2 feet high, with an oblong bulblet at the base; basal leaf narrowly linear, exceeding the stem only in dwarf plants; sepals smoky blue outside, inside yellowish, scarious margined, shorter than the petals; petals obovate-cuneate, rounded at the summit, white (or less commonly purplish) with yellow base and a smoky blue or inky spot above the gland; gland small, oval, thickly covered with yellow linear hairs and with some loose hairs immediately around the gland; anthers oblong, obtuse, slightly sagittate or after dehiscence strongly so.

Common in the Sierra Nevada from Shasta Co. south to Tulare Co., 5000 to 7500 feet. June-July. Petals ⅞ to 1¼ inches long.

Tax. Note.—This species is distinguished from the genuine C. nuttallii Torr. of the Great Basin region by the absence of any membrane surrounding the gland, by the uniformly linear hairs on the surface of the gland, which are never laciniate tipped, by the thinner-walled more ovoid capsule, and by the sagittate anthers. After dehiscence the 4 anther valves spread from the base in pairs (one valve from each cell) and the anthers become strongly sagittate.

Locs.—Pine Creek, Lassen Co., *Baker & Nutting*; Mill Creek Cañon, Tehama Co., *Hall & Babcock* 4355; Jameson Creek, Plumas Co., *Hall* 9311; Webber Lake, Sierra Co., *S. B. Doten*; Donner Lake, *Sonne*; Sonora Pass, *A. L. Grant*; Belle Mdw., Tuolumne Co., *Jepson* 6471; Yosemite, *Jepson* 4251; Lake Merced, *Jepson* 3212; Huntington Lake, Fresno Co., *A. L. Grant*; Long Mdw., Tulare Co., *Jepson* 734.

Refs.—CALOCHORTUS LEICHTLINII Hook. Bot. Mag. t. 5862 (1870), type loc. Sierra Nevada, *Roezl*; Purdy, Proc. Cal. Acad. ser. 3, 2:148 (1901). *C. nuttallii* T. & G. Pac. R. Rep. 2:124 (1855), type loc. Noble Pass, Shasta Co., *Snyder* (not C. nuttallii Torr.). Var. *subalpinus* Jones, Contrib. 12:78 (1908), the form of high altitudes (not C. subalpinus Piper, 1906).

5. **C. luteus** Dougl. YELLOW MARIPOSA. (Fig. 51e.) Stem erect, slender, often branching, ½ to 1 or 2 feet high; bulblets enclosed within radical sheath of stem; basal leaves linear, 1 to 3 lines wide; sepals yellowish within; petals fan shaped, as long as broad, ¾ to 2 inches long, yellow or orange, rarely white, with or usually without a central brown blotch but with horizontal series of vertical pencilings radiating from gland to center of petal; gland transverse, broadly linear or lunate, usually not reaching quite to edges of petal, densely hairy, with ascending matted yellow hairs; hairs below middle of petal few and scattering; capsule linear-oblong, 1¼ to 1¾ inches long.

Foothills and low rolling gravelly or dry land: Coast Ranges from Mendocino Co. south to San Luis Obispo Co.; borders of the Sacramento and San Joaquin

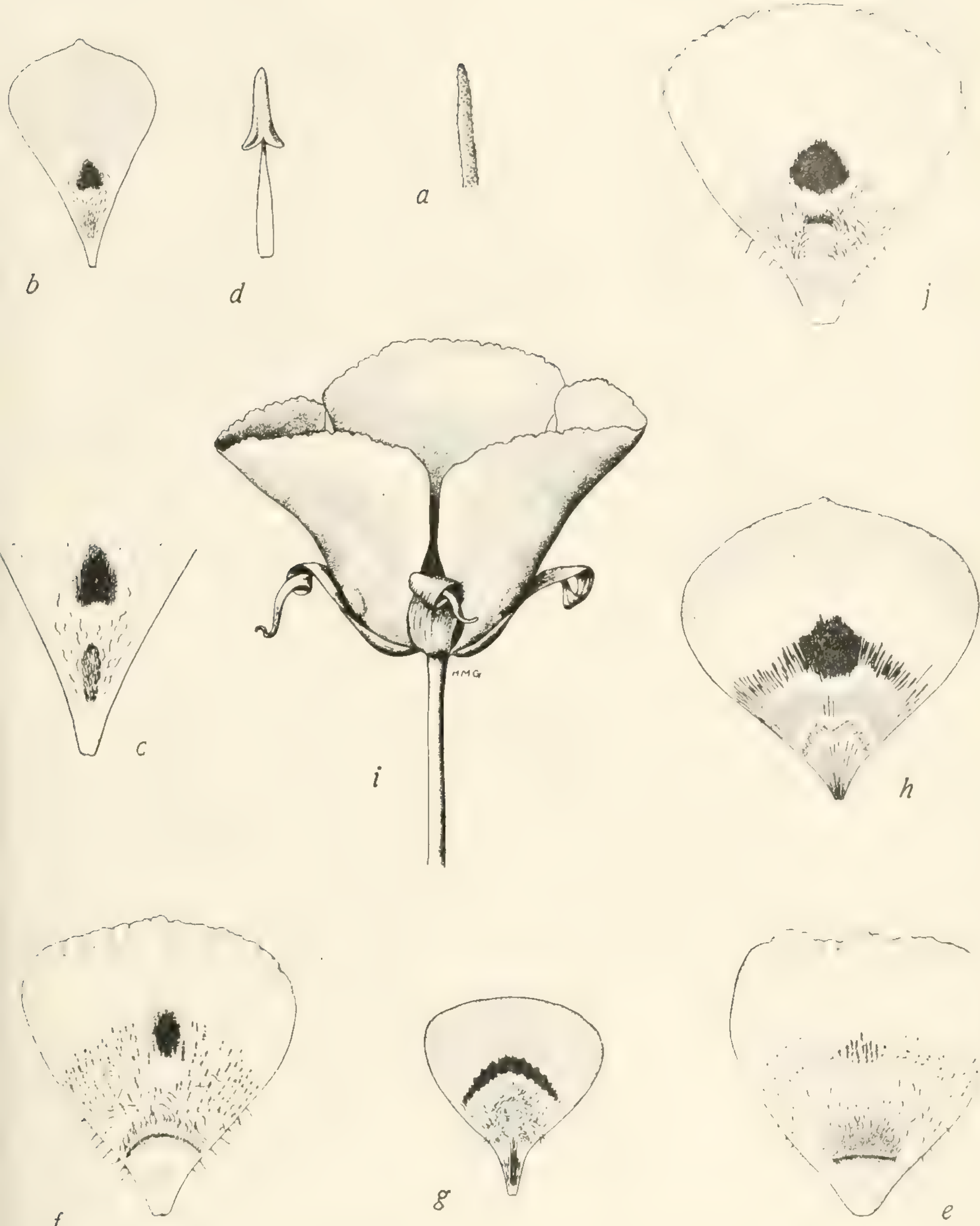

Fig. 51. *a*, CALOCHORTUS PALMERI Wats., hair from gland, × 18. *b*, C. LEICHTLINII Hook.; petal, × 1; *c*, gland, × 2; *d*, stamen, × 2. *e*, C. LUTEUS Dougl., petal, × 1. *f*, var. OCULATUS Wats., petal, × 1; *g*, another petal form, × 1. *h*, var. VESTA Jepson, petal, × 1. *i*, C. VENUSTUS Dougl., flower, × 1; *j*, petal, × 1.

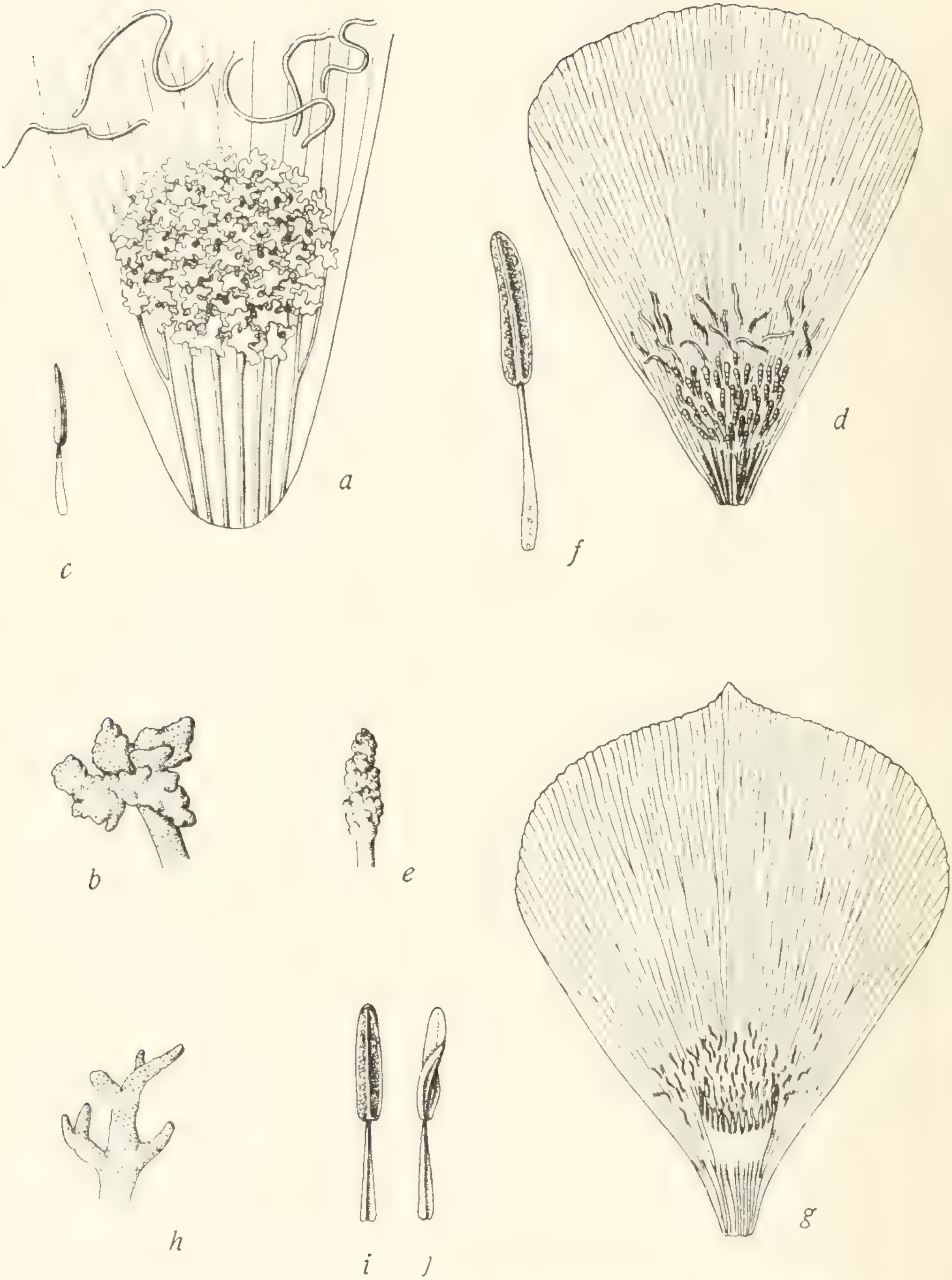

Fig. 52. *a*, CALOCHORTUS SPLENDENS Dougl., gland, × 7; *b*, hair from gland, × 18; *c*, stamen, × 1. *d*, C. INVENUSTUS Greene, petal, × 3; *e*, hair from gland, × 18; *f*, stamen, × 3. *g*, C. NUTTALLII Torr., petal, × 3; *h*, hair from gland, × 18; *i*, stamen, × 3; *j*, stamen after dehiscence of anther, × 3. The glands in this genus generally bear glandular processes, here for convenience called hairs, which are of great importance for specific differentiation. They are described for the first time in this work and are in many cases illustrated by figures.

valleys; and in the Sierra Nevada foothills, mostly below 1800 or 2500 feet. May-June. The most abundant species; extremely variable in color and markings; commonly in the hardest gravel-packed soil.

Locs.—Windsor, Sonoma Co., *Jepson* 7656; Crystal Sprs., San Mateo Co., *Eastwood*; Los Gatos, *Heller* 7387; San Luis Obispo Co., *Rhoda Reed*; Monterey Co., *Purdy*. We have seen no specimens from Southern California. The following are color forms: Var. **citrinus** Wats., whole petal orange-yellow with a central brown spot.—North Coast Ranges to Sierra foothills: Bear Valley, w. Colusa Co., *Jepson* 8969 (dark purple eye-spot, gland crescent-shaped), 9012 (black eye in a spot of orange, gland half moon shaped); Howell Mt. foothills, *Jepson* 2432; Vacaville, *Jepson* 4245; Sacramento, *Shockley* 397; Jackass Hill, Tuttletown, *Wm. Grant*. Var. **oculatus** Wats. (Fig. 51 f, g); petals white or cream with a central round or transverse brown spot bordered with yellow. North Coast Ranges (acc. Purdy) to the Sierra foothills: Redding, *Heller* 7845; Columbia, *Helen Gilkey;* Jones Sta., Middle Tuolumne River, *A. L. Grant* 836; Dunlap, Fresno Co., *Jepson* 2755.

Var. **vestae** Jepson n. comb. (Fig. 51h.) Petals pure white above the purple brown eye-spot, heavily penciled between the eye-spot and the gland; gland very narrow, extending in a long arching curve from side to side of the petal and notched or as if interrupted at the summit of the arch (that is "doubly lunate").—Blue adobe soil, interior Sonoma Co. to Humboldt Co.

Locs.—Anderson Valley, acc. *Purdy*; Larribee Creek, *Tracy* 4713; Buck Mt., *Tracy* 4513.

Refs.—CALOCHORTUS LUTEUS Dougl.; Lindl. Bot. Reg. t. 1567 (1833), type from Cal., *Douglas*; Wats. Proc. Am. Acad. 14:265 (1879); Bot. Cal. 2:175 (1880); Jepson Fl. W. Mid. Cal. 112 (1901). Var. CITRINUS Wats. l.c. *C. venustus* Dougl. var. *citrinus* Baker, Jour. Linn. Soc. Bot. 14:310 (1874), type from Cal., *Bridges* 284. Var. OCULATUS Wats. l.c. Var. VESTAE Jepson. *C. venustus* var. *vesta* Purdy in Bailey, Cycl. Am. Hort. 1:221 (1902). *C. vesta* Wallace, Gard. Chron. ser. 3, 18:14 (1895); Purdy, Proc. Cal. Acad. ser. 3 (Bot.), 2:139 (1901), type loc. Ukiah Valley, *Purdy*.

6. **C. venustus** Dougl. WHITE MARIPOSA. (Fig. 51i, j.) Stem erect, stiff, usually branching, 4 to 10 inches or up to 2 or 4 feet high, 1 to 4-flowered; bulblet at base usually 1; petals broadly cuneate-obovate, 1 to 1¾ inches broad, 1 to 2½ inches long, white, varying to pale rose-color or lilac, with a red-brown eye-spot above the gland, frequently penciled toward the base, and often with a transversely oblong rose-colored blotch near the apex; gland roundish, or quadrate, densely matted with short hairs, a few scattered hairs near the gland; capsule linear, 2 to 3½ inches long.

Frequent in light sandy or alkaline soil: Coast Ranges from Mendocino Co. south to Los Angeles Co.; borders of the Sacramento and San Joaquin valleys; Sierra Nevada foothills and up to 2500 or even 5000 feet. June-July.

Quite constant in the shape of the gland and infinitely variable in its color markings. One finds hillslopes in the Sierras, dotted with hundreds of individuals, but no two flowers exactly alike in the details of the color pattern.

Locs.—Tejon Pass, *Hall* 6265a; Ojai Valley, *Olive Thacher*; San Luis Valley, *Summers* 844; Paso Robles, *Purdy*; Gilroy, *Jepson*; Coyote Creek, Santa Clara Co., *Jepson*; Niles, *Jepson*; Mt. Diablo, *Jepson* 7571; Vacaville, *Jepson*; Round Valley, Mendocino Co., *Westerman;* Morley's Sta., Shasta Co., *Baker & Nutting;* Murphy, *A. L. Grant;* Columbia, *Jepson* 6346, *Helen Gilkey*; Linden, San Joaquin Co., *Gunnison*; Hamilton's, Mariposa Co., *A. L. Grant*; Eight Mile, Wawona Road, *Jepson* 4294; Miami Lodge, Mariposa Co., *Jepson* 8398; Cascada, Fresno Co., *A. L. Grant* (petals bronze color); Greenhorn Range, *Hall & Babcock* 5054.

Refs.—CALOCHORTUS VENUSTUS Dougl.; Benth. Trans. Hort. Soc. Lond. ser. 2, 1:412, pl. 15, fig. 3 (1835), type from Cal., *Douglas;* Jepson, Fl. W. Mid. Cal., 111 (1901). Var. PURPURASCENS Wats. Proc. Am. Acad. 14:266 (1879), "petals deep lilac or purplish with similar markings."—Kern Co. Var. SULPHUREUS Purdy, Proc. Cal. Acad. ser. 3, 2:141 (1901), petals light yellow, oculated.—Newhall and Alcalde.

7. **C. splendens** Dougl. LILAC MARIPOSA. (Fig. 52a-e.) Stem erect, 1 to 2 feet high; sepals with a small purplish black spot at the base; petals fan-shaped, clear lilac with long scattered hairs on the lower third or fourth; gland small, round or oval, situated very low on the base of the petal or sometimes absent; gland surface covered with broad hairs whose expanded fungoid stellate tips form a dense mass; capsule narrowly linear, 1½ to 2 inches long.

Contra Costa and Monterey cos. southward to San Diego Co. Common on half-open or bushy hills or mesas. May. Petals $1\frac{1}{8}$ to $1\frac{3}{4}$ inches long.

Locs.—Mt. Diablo, *Jepson* 8326; Carmel River Valley, *Ferguson* 253; Waltham Creek, San Carlos Range, *Jepson* 2659; Atascadero, *Brewer* 507; Cajon Pass, *Jepson* 6099; e. San Bernardino Valley, *Jepson* 5544; Riverside, *Jepson* 1228; San Timoteo Cañon, *Jepson* 6081; San Jacinto Cañon, *Hall* 2014; Santa Aña Mts., *Alice King*; San Diego, *T. Brandegee*.

Ref.—CALOCHORTUS SPLENDENS Dougl.; Benth. Trans. Hort. Soc. Lond. ser. 2, 1:411, pl. 15, fig. 1 (1835), type from Cal., *Douglas*.

8. **C. invenustus** Greene. (Fig. 52d-f.) More slender and shorter than C. splendens; stems 8 to 12 inches high, bulblet-bearing at the base; petals smaller, the scattered hairs short; gland irregular, spreading, fan-shaped; gland hairs cylindrical or subclavate with knobbed sides, not expanded stellate.

Moist spots, plateau valleys in the mountains bordering on the west the desert region of Southern California, 4000 to 6500 feet; somewhat rare. May.

Locs.—Vandeventer, *Jepson* 1462; San Jacinto Mts., *Reinhardt*; Rock Creek, *Peirson* 9; Leonis Valley, *Davy* 2608; Tehachapi, *Greene*.

Refs.—CALOCHORTUS INVENUSTUS Greene, Pitt. 2:71 (1890), type loc. Tehachapi, *Greene*. *C. splendens* var. *montanus* Purdy, Proc. Cal. Acad. ser. 3, 2:143 (1901), type loc. Raynetta, Mt. San Jacinto. *C. invenustus* var. *montanus* Parish, Bull. S. Cal. Acad. 1:124 (1902). *C. montanus* Davidson, Bull. S. Cal. Acad. 9:54 (1910).

9. **C. nuttallii** Torr. SEGO LILY. (Fig. 52g-j.) Stem 3 to 17 inches high, bulblet-bearing at base; basal leaf shorter than the stem or sometimes equaling it in dwarf forms; flowers solitary or in umbels; bracts with white-scarious margins; sepals shorter than the petals; petals cuneate-obovate, apiculate, slightly erose, 1 to $1\frac{3}{4}$ inches long, white, sometimes shaded with lilac or with purple, often a darker purple spot near the gland, a few long linear hairs about the gland; gland oval, rarely circular, bordered by a more or less continuous laciniated membrane and covered with hairs more or less laciniate at the tips; anthers yellow, oblong-linear, obscurely sagittate at base, commonly tortuous after dehiscence, slightly longer than the filaments; capsule linear, 2 to $2\frac{1}{2}$ inches long, attenuate at both ends.

Arid mountains or valleys, 4000 to 10,000 feet; east slope of the Sierra Nevada and south to the high ranges bordering the deserts in Southern California; east to the Rocky Mts.

Locs.—Honey Lake, *T. Brandegee*; Volcano Creek, Tulare Co., *Hall & Babcock* 5426; Mt. Pinos, *Hall* 6506. The Owens Valley plants have purplish maroon anthers (= *C. excavatus* Greene): White Mts., *Jepson* 7247; Bishop, *Almeda Nordyke*. The following from Southern California are more slender but agree technically with the species: Lytle Creek Cañon, Mt. San Antonio, *Hall* 1452; Bear Valley, San Bernardino Mts., *Parish* 3159; Santa Ana Cañon, *Hall* 7655; Mt. San Jacinto, *Jepson* 2321. The following are extra-limital: Verdi, Washoe Co., Nev., *Sonne*; Mangas Sprs., N. M., *O. B. Metcalfe*; Indian Creek, Carbon Co., Wyo., *Goodding*; Malheur River, e. Ore., *Cusick* 2544.

Refs.—CALOCHORTUS NUTTALLII Torr. in Stansbury Expl. Utah, 397 (1852), type loc. Salt Lake Valley, Utah, *Stansbury*; Purdy, Proc. Cal. Acad. ser. 3, 2:146 (1901) in part. *C. leichtlinii* of many authors as to Great Basin or Rocky Mt. plants. *C. excavatus* Greene, Pitt. 2:71 (1890), type loc. Bishop Creek, Inyo Co., *Shockley* 427. *C. discolor* Davidson, Bull. S. Cal. Acad. 14:11 (1915), type loc. Bishop, *Davidson* 2672. *C. campestris* Davidson, Bull. S. Cal. Acad. 14:12 (1915), type loc. Bishop, *Davidson* 2657. Petals pink; gland circular.—Ex. char. *C. acuminatus* Rydb. Bull. Torr. Club 24:189, pl. 301 (1897), type loc. Lima, Montana, seems close to C. nuttallii but has narrower more acuminate petals.

10. **C. macrocarpus** Dougl. (Fig. 53a, b.) Stem bulbiferous at base, stout, erect, 1 to 2 feet high; cauline leaves 3 to 5, narrow and convolute; sepals long-lanceolate, stiffly spreading, purple inside, equaling or slightly exceeding the petals; petals persistent until capsule has reached almost mature size, long obovate, prominently apiculate, $1\frac{1}{2}$ to $2\frac{1}{4}$ inches long and $\frac{3}{4}$ inch wide, purple-lilac, lighter at base and sometimes with a deeper band below middle, a greenish median line on the back, the lower third of petal white and with scattered hairs

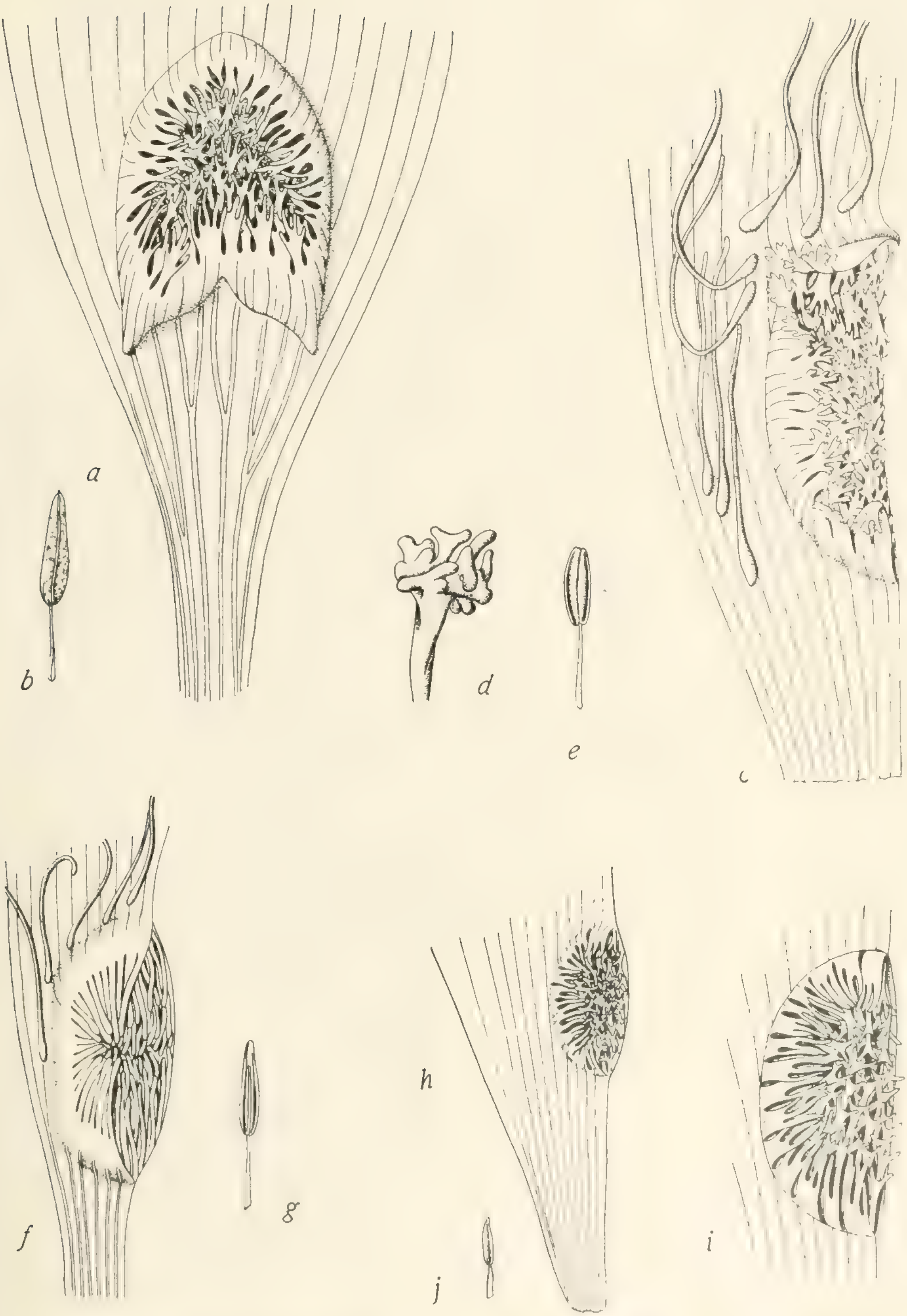

Fig. 53. *a*, CALOCHORTUS MACROCARPUS Dougl., gland, × 7; *b*, stamen, × 1. *c*, C. CLAVATUS Wats., gland, × 7; *d*, hair from gland, × 18; *e*, stamen, × 1. *f*, C. CONCOLOR Purdy, gland, × 7; *g*, stamen, × 1. *h*, C. KENNEDYI Porter, base of petal, × 7; *i*, gland, × 12; *j*, stamen, × 1.

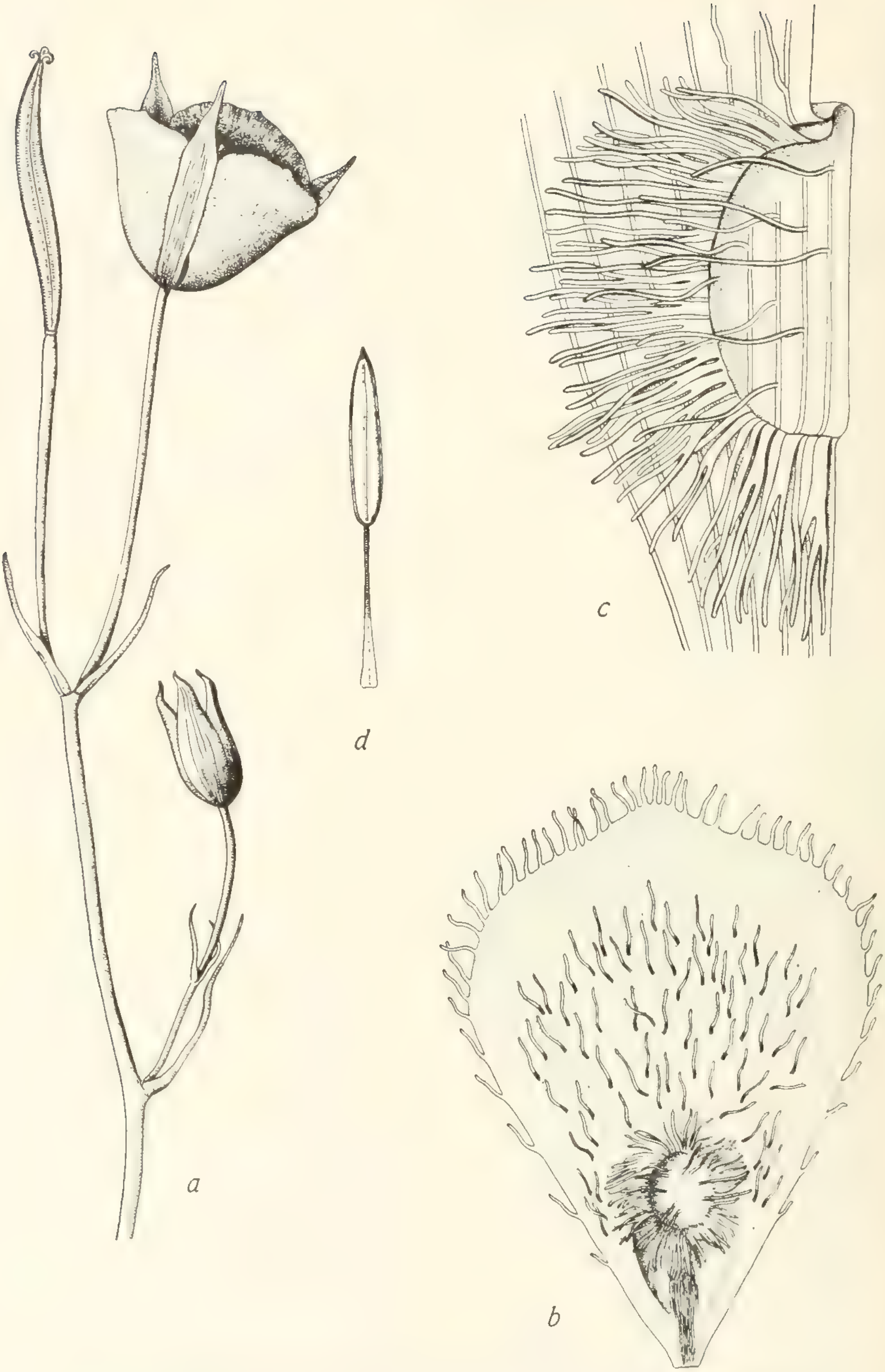

Fig. 54. CALOCHORTUS WEEDII Wood; *a*, habit, × 1; *b*, petal, × 3; *c*, gland, × 12; *d*, stamen, × 2.

above the gland; gland broadly A-shaped or oval with a notch on the lower side, bordered by a continuous doubly laciniate membrane and densely covered with broad hairs whose divided clavate tips form a compact mass; anthers purple or yellow, ovate-lanceolate, acutish, 4 to 7 lines long; capsule attenuate, 1½ to 2¼ inches long; seeds round, flat, 2¼ lines in diameter.

Dry sandy soil in the interior: Lassen and Modoc cos. North to British Columbia.

Locs.—Susanville, *T. Brandegee;* Eagle Lake, *M. S. Baker;* Mt. Bidwell, *Jepson* 7857.

Ref.—CALOCHORTUS MACROCARPUS Dougl. Trans. Hort. Soc. Lond. 7:276, pl. 8 (1830), type loc. near the Great Falls of the Columbia River, *Douglas.*

11. **C. clavatus** Wats. (Fig. 53c-e.) Stem very stout, stiff, strongly zigzag, branching, 1 to 3 feet high; cauline leaves broad; pedicels stout, 2 to 5 inches long; flowers bowl-shaped; sepals yellowish within, often purplish spotted, greenish without, with dry scarious margins; petals rich yellow, broadly fan-shaped, rather truncate, 1½ to 2 inches long, 1½ to 2¼ inches wide, strongly arched, hairy below the middle or only near the gland, often with a narrow reddish brown or lilac band above the hairy zone, the claw often reddish brown; hairs of the petals scattered, yellow, purplish red at base, the tips narrowly clavate; gland circular, bordered by an annular membrane, its inner edge deeply twice incised; gland surface thickly covered with very broad hairs with much divided or coralline tips; anthers ovate-oblong, obtuse, purplish brown, shorter than the slender filaments; capsule linear, attenuate above and below, 3 inches long.

Dry rocky points, usually in volcanic soils: South Coast Ranges (San Benito Co. to Los Angeles), infrequent; rare in the central Sierra Nevada. May.

Locs.—Coast Ranges (sepals ⅔ the length of the petals and gland in a shallow pocket): San Carlos Creek, *Jepson* 2730; Arroyo Grande, *Alice King*; Ojai Valley, *Olive Thacher*; San Fernando, comm. by *Elizabeth Palmer;* Mint Cañon, San Gabriel Mts., *Pearson* 288. Sierra Nevada (sepals equal to or exceeding the petals, the gland in a deep pocket): Pleasant Valley, Eldorado Co., *Purdy*; White Rock, Mariposa Co., acc. Purdy.

Ref.—CALOCHORTUS CLAVATUS Wats. Proc. Am. Acad. 14:265 (1879), type loc. San Luis Obispo, *Lemmon.*

12. **C. concolor** Purdy. GOLDEN-BOWL MARIPOSA. (Fig. 53f, g.) Stem 2 feet high, one to several-flowered; bulb large, reddish; pedicels stout, 1 to 3 (or 5) inches long; sepals yellowish within, purple banded, purplish-brown on the back; petals deep rich yellow tending toward orange, generally with a purplish band just above the lower third of the petal, broadly fan-shaped, 1½ to 2 inches long and as broad as long, slightly rounded at summit, the lower third or fourth thickly hairy with long erect yellow hairs; gland small, rounded oblong, covered by a deeply laciniate annular membrane, the linear divisions of the membrane converging in the center over the gland like an iris diaphragm; surface of the gland thickly covered with narrowly linear mostly entire hairs; anthers yellow, linear, slightly exceeding the filaments; capsule strongly triquetrous, lance-linear, attenuate above.

Bushy often rocky hills, cismontane Southern California from San Diego Co. north to San Bernardino.

Locs.—Crafton, acc. *Parish*; Chalk Hill, Mt. San Jacinto, *Hall* 2285; El Toro Mt., *Hall*; Santa Isabel Creek, *Stephens*; San Vicente Rancho, Ramona, *K. Brandegee*; Cuyamaca Mts., acc. Purdy.

Refs.—CALOCHORTUS CONCOLOR Purdy, Proc. Cal. Acad. ser. 3, 2:135 (1901), type loc. Laguna, San Diego Co., *D. Cleveland.* *C. luteus* var. *concolor* Baker, Garden, 48:440, pl. 1043 (1895); the colored plate is a very fine one.

13. **C. kennedyi** Porter. (Fig. 53h-j.) Stem rather stout, 2 to 6 (rarely 8 to 14) inches high, 2 to 4-flowered; flowers in umbels; pedicels 1 to 4 inches long; sepals ½ to ⅔ the length of the petals, vermilion or orange inside, often spotted with brown near the base, brownish without, with white-scarious margins; petals

cuneate, rather truncate, $\frac{3}{4}$ to $1\frac{1}{2}$ inches long, nearly as broad, flame-color, brilliant vermilion or rarely orange, naked above, a few scattered hairs below, sometimes with a black band or patch on the lower portion; gland very small, circular, bordered by a narrow black annular membrane with the inner ashy-gray edge laciniate, its surface thickly covered with short slender hairs, the hairs orange below, ashy above, once or twice dichotomously cleft; anthers brownish-purple; capsule $1\frac{1}{2}$ to 2 inches long, 4 to 5 lines wide, attenuate above, the sides light-colored but often bordered at the angles with a stripe of purplish-brown.

Hard clay or gravelly soil: Mohave Desert west to Ventura Co., east to southern Nevada and Arizona. Frequent. May.

Locs.—Mt. Pinos, *Hall;* Cuddy Cañon, Kern Co., *Hall*; New York Mts., *Jepson* 5447; Warrens Well, *Jepson;* Ord Mt., *Jepson* 5880; Stoddard's Well, *Jepson* 5906; Victorville, *Hall.*

Refs.—CALOCHORTUS KENNEDYI Porter, Bot. Gaz. 2:79 (1877), type loc. Kern Co., *W. L. Kennedy. C. speciosus* Jones, Contrib. W. Bot. 14:28 (1912).

14. **C. weedii** Wood. Weed's Mariposa. (Fig. 54.) Stem 1 to $2\frac{1}{2}$ feet high, usually much branched, stout and flexuous, leafy, 1 to many-flowered, not bulbiferous; sepals shorter than or often exceeding the petals, narrowly ovate-lanceolate, yellowish within, scarious-margined; petals broadly cuneate, rounded above, sometimes apiculate, orange-color to lemon yellow, nearly covered with long silky hairs each set in a small dark spot, or the upper fourth or fifth naked; upper margins of petals fringed or serrate; gland small, circular, enclosed by a dense ring of hairs and generally bearing a few scattered hairs on its surface; anthers oblong-linear, shorter or longer than the filaments; capsule narrowly oval, attenuate above, $1\frac{1}{2}$ inches long.

Dry hills, San Diego Co.; south to Lower California. June. Common on the coast. Flowers 1 to $1\frac{1}{4}$ inches long.

Locs.—Palomar, *Jepson & Hall;* Capitan School, *K. Brandegee*; Laguna Mts., *T. Brandegee;* Valley Center, *Chandler* 5440; San Diego, *K. Brandegee;* Del Mar, *Jepson* 1611; Rainbow, *Parish* 4458.

Var. **vestus** Purdy. Petals truncatish, reddish brown, covered with golden hairs, the upper third with brown hairs, and the margin fringed with brown hairs; anthers oblong-lanceolate.—Santa Barbara and Ventura cos.: Ojai Valley, *Olive Thacher.*

Refs.—CALOCHORTUS WEEDII Wood, Proc. Acad. Phila. 20:169 (1868), type loc. San Diego, *Weed;* Purdy, Proc. Cal. Acad. ser. 3, 2:132, pl. 17 (1901). Var. VESTUS Purdy l.c. 133, type loc. Santa Barbara, *Purdy.*

15. **C. obispoensis** Lemmon. Habit of C. weedii; sepals $\frac{1}{3}$ to $\frac{1}{4}$ longer than the petals; petals ovate, acuminate, the tips generally black and fringed with long black hairs; gland circular to oblong, enclosed by a dense ring of very long orange hairs, the surface naked or bearing a very few scattered hairs; anthers oblong, obtuse, shorter than the filaments; capsule linear, 1 to $1\frac{1}{2}$ inches long.

Cañons of the hills and mountains, San Luis Obispo Co.

Locs.—Santa Lucia Mts., *Summers*; San Luis Obispo, *Rhoda Reed*; Arroyo Grande, *F. Lowe.*

Refs.—CALOCHORTUS OBISPOENSIS Lemmon, Bot. Gaz. 11:180 (1886), type loc. San Luis Obispo, *Lemmon. C. weedii* var. *obispoensis* Purdy, Proc. Cal. Acad. ser. 3, 2:133 (1901).

16. **C. plummerae** Greene. Habit of C. weedii; corms large, often 2, enclosed side by side in a dense fibrous coat; sepals lanceolate (white-scarious margined at base), elongated attenuate, exceeding the petals; petals cuneate, apiculate or rounded above, lilac or lilac-purple with orange-colored hairs on lower half, the hairs usually arising from deep purple spots; gland small, circular, pocketed, enclosed by a dense ring of long orange-colored hairs gathered together above the gland, its surface naked or sometimes bearing one or few solitary hairs; capsule narrowly linear, $1\frac{1}{4}$ to $3\frac{1}{4}$ inches long.

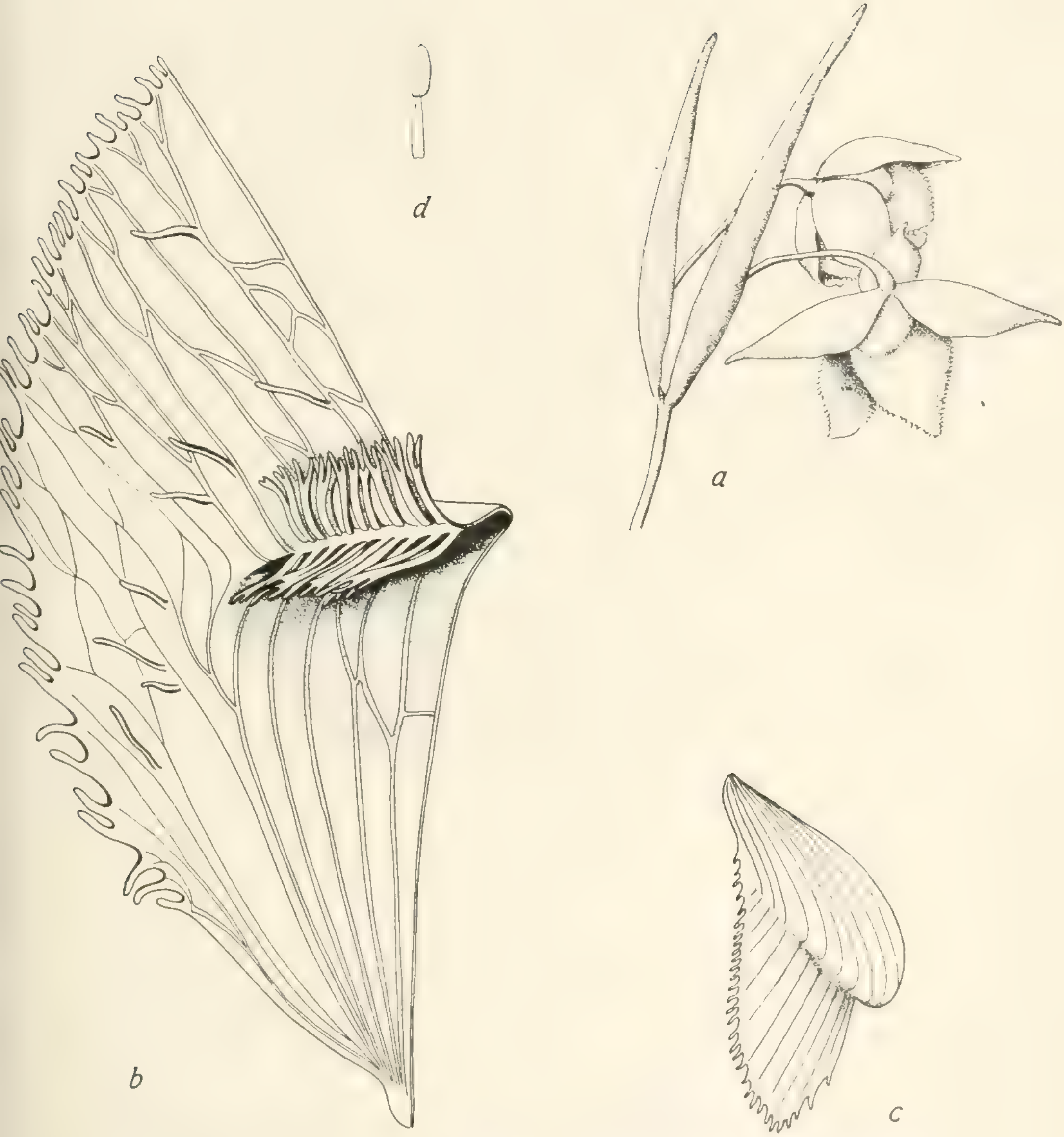

Fig. 55. Calochortus pulchellus Dougl. *a*, flowering branchlet, × 1; *b*, petal (median longitudinal section, showing the inner face), × 7; *c*, petal (outer face), × 3; *d*, stamen, × 2.

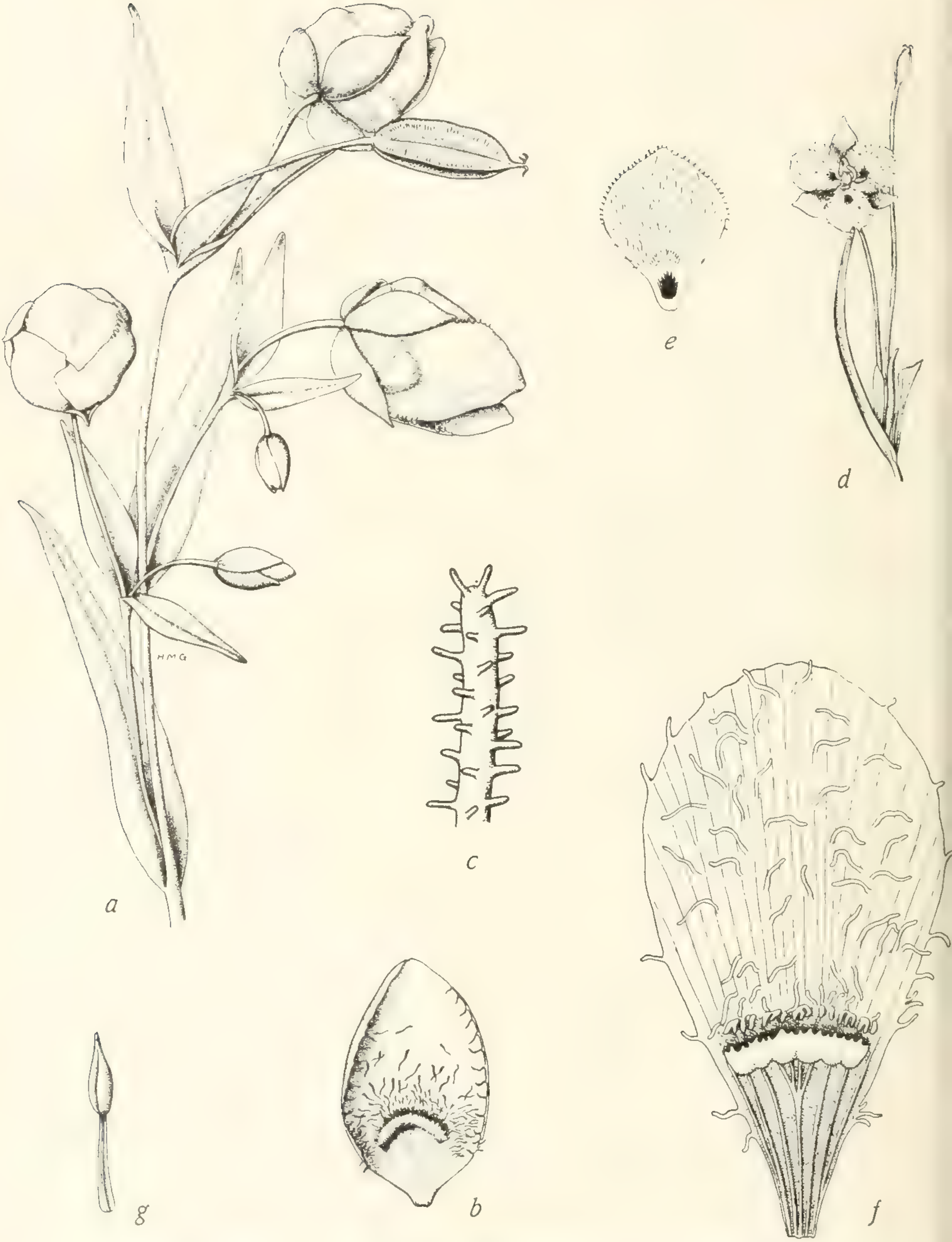

Fig. 56. *a*, CALOCHORTUS ALBUS Dougl., flowering branch, × 1; *b*, petal, × 1½. *c*, var. RUBELLUS Greene, hair from gland, × 24. *d*, C. MONOPHYLLUS Jepson, flowering branchlet, × 1; *e*, petal, × 2; *f*, petal, × 5; *g*, stamen, × 4.

Dry slopes and mesas: Santa Monica Mts., through the San Gabriel and San Bernardino mountains to the San Jacinto Mts. Common.

Locs.—Plants of the region from Newhall to San Bernardino have evenly shaded petals and the gland pocket shallow; plants from the San Jacinto Mts. have the petals conspicuously purple spotted and the gland in a deeply folded pocket forming a conspicuous convex ridge on the outside. Newhall, *Barber* 176; Santa Monica Mts., *J. Q. Adams*; Rubio Cañon, foothills east, *Peirson* 8; Cajon Pass, *Hall* 1417; San Bernardino, *Parish*; San Jacinto Mts., *G. F. Rinehardt.*

Refs.—Calochortus plummerae Greene, Pitt. 2:70 (1890), type loc. Mill Creek Cañon, San Bernardino, *Lemmon*. *C. weedii* var. *purpurascens* Wats. Proc. Am. Acad. 14:265 (1879), based primarily on spms. from Cajon Pass (acc. McB. Contrib. Gray Herb. 56:13).

17. **C. pulchellus** Dougl. Golden Lily Bell. Fairy Lantern. (Fig. 55.) Stem flexuous, usually dichotomously branching, ½ to 1¾ feet high, 2 or 3 to 12-flowered; basal leaf ½ to ¾ inch wide, equal to or taller than the stem, green, glossy, sometimes tinged with purple; bracts linear-lanceolate, equaling or exceeding the flowers; flowers sub-globose, nodding; sepals greenish or brownish-yellow, ovate-lanceolate to elliptic-ovate, abruptly acute, 10 to 15 lines long, slightly shorter than the sub-orbicular petals; petals golden yellow, strongly arched or incurved, their apices overlapping and the margins bluntly incised or fringed; gland in a deeply set pocket (visible from the outside as a convex ridge), its upper fold bearing 2 or 3 rows of appressed glandular yellow hairs crossing each other over the opening of the pocket; hairs of the gland simple or with divided tips; petals with scattered hairs above the gland or rarely almost glabrous; anthers oblong, acute, 2 lines long, usually a little shorter than the filaments; capsule elliptical, abruptly short-beaked, winged, ¾ to 1¼ inches long.

Wooded hills, Mt. Diablo and in the North Coast Ranges from Marin and Solano cos. north to Humboldt and Tehama cos. Apr.-May.

Tax. Note.—In most plants from the North Coast Ranges the petals have very few hairs, usually (but not always) near the gland (= *C. amabilis* Purdy, Proc. Cal. Acad. ser. 3, 2:119,—1901; *C. pulchellus* var. *amabilis* Jepson, Fl. W. Mid. Cal. 113,—1901). In most plants from Mt. Diablo the hairs are scattered generally over the surface of the petal (the form taken by Purdy, l.c., as typical *pulchellus*), but other plants from Mt. Diablo have few hairs and thus match North Coast Range specimens, so that the form C. amabilis is not sufficiently distinct even for a variety. Over and above these considerations it may be pointed out that Bentham's statement, petal above the gland slightly covered with scattered hairs, may be applied to plants of both regions. The margins of the petals in North Coast Range plants, while generally short-fringed, are sometimes long-fringed as in Mt. Diablo specimens.

Locs.—Mt. Diablo, *Jepson* 7570, *Eastwood*, *Purdy*; Corte Madera, *Heller* 7364; Los Guilicos, *Michener & Bioletti*; Santa Rosa Creek Cañon, *M. S. Baker*; Howell Mt., *Tracy*; Ukiah, *Purdy*; Fort Seward, Humboldt Co., *Tracy*; Laribee Creek, Humboldt Co., *Tracy* 4711; Crane Creek, w. Tehama Co., *Jepson* (petals almost glabrous, a few hairs near the gland); Island Mt., Trinity Co., *Marion R. Parsons.*

Refs.—Calochortus pulchellus Dougl.; Benth. Trans. Hort. Soc. Lond. ser. 2, 1:412, pl. 14, fig. 1 (1835), type from Cal., *Douglas*; Wood, Proc. Acad. Phila. 20:168 (1868); Purdy, Proc. Cal. Acad. ser. 3, 2:118 (1901). *Cyclobothra pulchella* Benth. l.c.; Lindl. Bot. Reg. t. 1662 (1835). *Calochortus amabilis* Purdy l.c. 119; Jepson, Fl. W. Mid. Cal. ed. 2, 98 (1911).

18. **C. albus** Dougl. White Globe Lily. (Fig. 56a, b.) Stem stout, glaucous, branching, 1 to 2 feet high; basal leaf elongated lanceolate, acuminate, 1 to 1½ feet long, ⅓ to 1⅜ inches wide; bracts foliaceous, 3 to 5 inches long; sepals shorter than the petals, ovate, acuminate, greenish-white; petals white, purplish at base, ovate-orbicular, acutish, with scattering long silky yellow hairs above the gland, 1 to 1¼ inches long; gland lunate, shallow, with 4 transverse scales, the scales upwardly imbricate, shortly fringed; anthers oblong, mucronate; capsule 1 to 2 inches long, ½ to 1 inch broad, abruptly short-beaked; seeds brown, pitted.

Wooded slopes and cañons: Coast Ranges near the coast from the Santa Cruz Mts. southwards; San Gabriel and Cuyamaca mountains in Southern California (rare southwards); Sierra Nevada from Butte Co. southwards. May. Called Snow-drops in Tuolumne and Calaveras cos., Indian Bells in Calaveras Co., and Satin Bell in the Coast Ranges.

Locs.—South Coast Ranges: Burlingame, *M. S. Baker*; Niles; Los Gatos, *Heller*. Southern California: Ojai Valley, *Olive Thacher*; Little Santa Anita Cañon, San Gabriel Mts., *Peirson* 2163; Fish Cañon, San Gabriel Mts., *Peirson*; Claremont, acc. *I. M. Johnston*; Palomar, *Hall* 1937; Cuyamaca Mts., *Parish* 4422 (some petals with fringed margin like C. pulchellus); Santa Cruz. Isl., usually pale rose (Zoe, 2:78); Santa Rosa Isl., *T. Brandegee*. Sierra Nevada (plants somewhat smaller and the flowers apparently differing a little from the Coast Range form: Gwin Mine, Calaveras Co., *Jepson* 1773; Columbia, *Jepson* 6295.

Var. **rubellus** Greene. (Fig. 56c.) Generally lower and more slender; flowers rose-pink; gland scarcely arched, from the outside resembling a blood-blister.—Southern Sierra Nevada and the Santa Lucia and Santa Cruz mountains. June. Passes into the species.

Locs.—Samson Flats, Fresno Co., *Newhall*; Sand Creek, *Harriet Kelley*; Dunlap, *Jepson* 2768; Limekiln Creek, *Jepson*; Old Colony Mill, Sequoia Park, *Jepson* 642; Nelson, Middle Tule River, *Jepson* 4866; Lucia, Monterey Co., *Hall*; Ben Lomond (Zoe, 2:79).

Refs.—Calochortus albus Dougl.; Benth. Trans. Hort. Soc. Lond. ser. 2, 1:413, pl. 14, fig. 3 (1835), type from Cal., *Douglas*; Wood, Proc. Phila. Acad. 20:168 (1868); Jepson, Fl. W. Mid. Cal. 113 (1901); McB. Contrib. Gray Herb. 66:12 (1918). *Cyclobothra alba* Benth. l.c.; Lindl. Bot. Reg. t. 1661 (1835). Var. rubellus Greene, Erythea, 1:152 (1893), type loc. Pacific Grove, *Tidestrom*. Var. *amoenus* Purdy; Bailey, Stand. Cyclop. Hort. 2:632 (1914). *C. amoenus* Greene, Pitt. 2:71 (1890), type loc. Sierra Nevada east of Visalia, *Patterson*.

19. **C. monophyllus** Jepson. Yellow Star Tulip. (Fig. 56d-g.) Stem flexuous, branching, 3 to 8 inches high; basal leaf 9 to 12 inches high, 3 to 4 lines wide; bracts linear-lanceolate, acuminate, 2 to 4 lines wide; sepals narrowly ovate, acuminate, mucronate, about equaling petals; sepals and petals yellow or more or less purplish brown; petals obovate; gland semicircular, borne in a shallow pocket (appearing on the outside as a ridge) covered from below by a narrow laciniate scale, and densely bordered or crested above with short yellow (or the innermost white) hairs; hairs and laciniae of gland papillate; claw below the scale naked, often glandular, sometimes red-brown; capsule orbicular, 6 to 9 lines long.

Lower Yellow Pine belt of the Sierra Nevada from Shasta Co. to Tuolumne Co. Frequent. Apr. Petals 5 to 8 (or 9) lines long.

Locs.—Reed Road, Shasta Co., *M. S. Baker*; Brush Creek, Butte Co., *K. Conger*; Rough and Ready, Nevada Co., *Jepson*; Camino, El Dorado Co., *K. Brandegee*; Italian Bar, Tuolumne Co., *A. L. Grant*.

Refs.—Calochortus monophyllus Jepson, Madroño, 1:61 (1917). *Cyclobothra monophylla* Lindl. Jour. Hort. Soc. Lond. 4:81 (1849), type loc. Bear Valley, Nevada Co., *Hartweg* 371. *C. elegans* var. *lutea* Benth. Pl. Hartw. 338 (1857), type loc. Bear Valley, Nevada Co., *Hartweg* 371. *Calochortus benthamii* Baker, Jour. Linn. Soc. Bot. 14:304 (1874).

20. **C. caeruleus** Wats. Beavertail Grass. Stems short (1 to 7 inches high), the basal leaf 1 to 3 times as long; flowers 2 to 4 (or 10) in umbels; pedicels very slender; bracts small; petals rhombic-ovate, 3½ to 6 (or 7) lines long, white or pale blue, lilac-dotted and lined with blue, hairy, the margin fringed; gland narrow, transverse, curved, shallow, covered by an appressed somewhat fringed scale and crested by a row of short scales; these latter scales narrow, often hair-like, frequently laciniate or incised; capsule orbicular or nearly so, obtuse, 6 lines long.

Open woods, middle altitudes of the Sierra Nevada from El Dorado Co. to Shasta Co., and in the high North Coast Ranges from northern Lake Co. to Siskiyou Co. June.

Variation in gland: The narrow transverse gland is somewhat curved or lunate (Armstrong Sta., El Dorado Co., *Hansen* 1071; Blue Cañon, Placer Co., *H. A. Walker*; Nelson Pt., Plumas Co., *Hall* 9395; Marble Mt., *Chandler* 1646; Trinity Summit, *Jepson* 2035), rarely straight (Marble Mt., *Jepson* 2824), and varies in breadth from ⅓ to ¾ the width of the petal at the place of the gland in the specimens cited, even in the same lot of specimens (Marble Mt., *Jepson* 2824). These results do not sustain *C. nanus* Piper as distinct from C. caeruleus. C. caeruleus is most commonly found between 4000 and 7500 feet but occurs in typical form

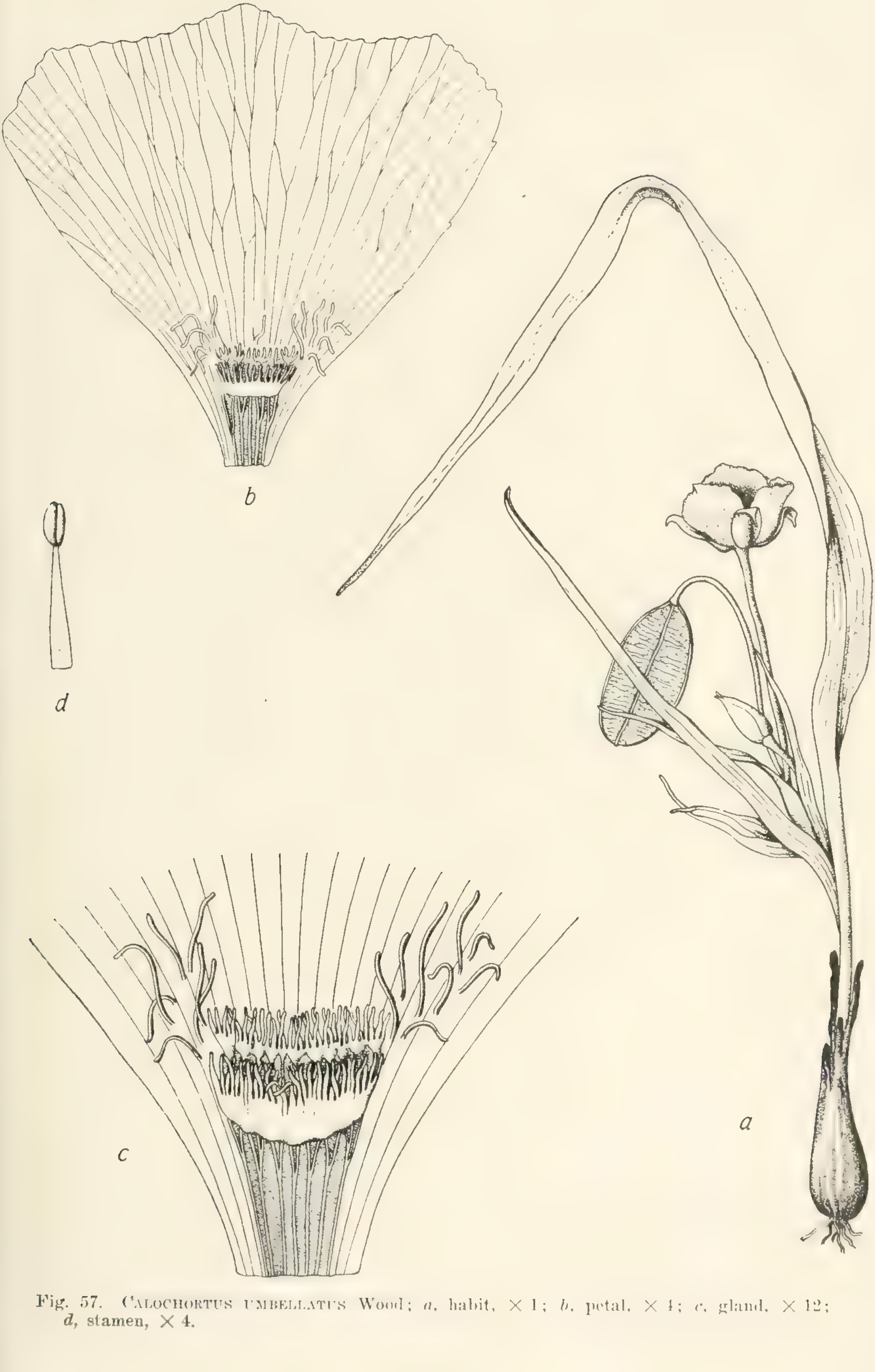

Fig. 57. CALOCHORTUS UMBELLATUS Wood; *a*, habit, × 1; *b*, petal, × 4; *c*, gland, × 12; *d*, stamen, × 4.

as low as 2300 feet (Dunsmuir, *Hall & Babcock*). Specimens from Stirling (*Heller* 10812) and Old Cow Creek, Shasta Co. (*M. S. Baker*), have the usual curved type of gland, but in coloration and size of flowers represent certain of the stages in the gradual transition to the var. maweanus. This variety indeed is too close to C. tolmiei H. & A. of the Willamette Valley, somewhat as the species is very closely allied to C. elegans Pursh of Idaho. The fimbriae of the scale and the crest are covered with slender microscopic papillae in both the species and the variety. While the variation of the gland in the species as here accepted is marked, it is far less than in, for example, C. luteus.

Var. **maweanus** Jepson n. comb. PUSSY EARS. Sepals commonly very blue; petals purplish blue to white, 7 to 11 lines long, the margin entire or nearly so; gland horseshoe-shaped or semicircular, narrow, more or less pocketed; crest usually rather dense.—Marin Co. north through the Coast Ranges to Humboldt Co.

Locs.—Inverness, comm. by *Alice King*; Rowe's, Mendocino Co., *Chandler*; Kneeland Prairie, *Tracy*; Dows Prairie, *Tracy* 4813.

Refs.—CALOCHORTUS CAERULEUS Wats. Proc. Am. Acad. 14:263 (1879). *Cyclobothra caerulea* Kell. Proc. Cal. Acad. 2:4 (1863), type loc. Forest City, near Downieville. *Calochortus elegans* var. *nanus* Wood, Proc. Acad. Phila. 20:168 (1868), type loc. Yreka, *Wood*. *C. nanus* Piper, Bull. Torr. Club, 33:537 (1906); McBr. Contrib. Gray Herb. 66:12 (1918). Var. MAWEANUS Jepson. *C. maweanus* Leicht.; Baker, Jour. Linn. Soc. Bot. 14:305 (1874), type from Cal., doubtless collected by Roezl; Jepson, Fl. W. Mid. Cal. 112 (1901); Purdy, Proc. Cal. Acad. ser. 3, 2:120 (1901). Var. *major* Purdy, l.c., a large form, Yellow Pine belt, Butte Co. *Cyclobothra elegans* Torr. Pac. R. Rep. 4:146 (1857). *Calochortus elegans* Hook. Bot. Mag. t. 5976 (1872), not Pursh.

21. **C. nudus** Wats. SIERRA STAR TULIP. Stem 2 to 6 inches high, flexuous, bearing a single umbel of 1 to 3 (or 9) flowers; basal leaf 3 to 10 inches long, 2 to 5 lines wide, light green; sepals oblong-elliptic, shorter than the petals; petals white or pale lilac-blue, cuneate or fan-shaped, acute, denticulate above, 4 to 7 lines long, generally without hairs, in some cases a very few slender hairs above the gland or a tuft of 2 or 3 short hairs at either end of the gland; scale transversely oblong, shortly fringed, appressed; crest none; claw below the scale somewhat glandular; anthers at first pale blue, linear, acute; capsule elliptic, generally nodding.

Open coniferous woods, high Sierra Nevada from Plumas Co. to Tulare Co. Also, apparently, in the San Gabriel Mts. June-July. The smallest-flowered Calochortus. Petals often with a flash of pink or purple above the gland.

Locs.—Warner Valley, Plumas Co., *Jepson* 4073; Cisco, *H. A. Walker*; Calaveras Big Trees, *A. L. Grant*; Center Camp near Confidence, *A. L. Grant*; Glacier Pt., Yosemite, *Jepson* 4344; Snow Creek, Fresno Co., *A. L. Grant* 1063; Round Mdw., Giant Forest, *Jepson* 673; Freeman Creek, Kern River, *Jepson* 4882a; (?) Mt. San Antonio, *Peirson* 289.

Var. **shastensis** Jepson n. comb. Stem 4 to 14 inches high, slender, flexuous, more or less erect; basal leaf shorter than, equal to, or longer than the stem; petals white, pale lilac blue to deep lilac, 6 to 10 lines long; capsule elliptic, generally erect, occasionally nodding.—Moist meadows; Sierra Nevada from Eldorado Co. north to Mt. Shasta; thence southwesterly to Trinity Co.

Locs.—Pyramid Peak, *Hall & Chandler* 4751; Kentucks, Shasta Co., *M. S. Baker* 439; McCloud, *I. J. Condit*; Sisson, *Hall & Babcock* 4067; Pin Creek, Trinity Co., *Hall* 8684.

Refs.—CALOCHORTUS NUDUS Wats. Proc. Am. Acad. 14:263 (1879), based on spms. from the northern Sierra Nevada. Var. SHASTENSIS Jepson. *C. shastensis* Purdy, Proc. Cal. Acad. ser. 3, 2:125 (1901), type loc. Sisson.

22. **C. umbellatus** Wood. (Fig. 57.) Stem 3 to 10 inches high, without bulblets, bearing 2 to 4 (or 12) flowers in 1 to 3 umbels subtended by leafy bracts, the pedicels long; herbage glaucous; sepals oblong, acuminate, greenish-white or slightly tinged with lilac; petals white or slightly lilac-tinged, cuneate or fan-shaped, slightly concave, 6 to 9 lines long; gland shallow, bowl-shaped in outline, covered from below by an appressed fringed scale and bordered by hairs on its upper side; petals otherwise naked save a hairy area (often with a purple spot below it) on each side of the gland; anthers short-oblong; capsule oblong-obtuse to orbicular, strongly nodding.

Low wooded or barren hills: region between San Ramon Valley and San Francisco Bay; Marin Co. to Mendocino Co. Mar.-Apr.

Locs.—Ft. Bragg, *W. C. Mathews*; Mt. Tamalpais, *Jepson* 7554, 8226; Berkeley, *Jepson*; Laundry Farm, *Purdy*; San Pablo Hills, *Hall*; Las Trampas, *Jepson*.

Refs.—CALOCHORTUS UMBELLATUS Wood, Proc. Acad. Phila. 20:168 (1868), type loc. Oakland Hills, *Wood*; Jepson, Fl. W. Mid. Cal. 112 (1901). *C. collinus* Lemmon, Erythea, 3:49 (1895), type loc. Oakland Hills.

23. **C. uniflorus** H. & A. Low, 4 to 10 inches high, the stem very short (commonly rising only ¼ to 1 inch out of the ground) and bearing 1 to 3 umbels with elongated flexuous pedicels (2½ to 8 inches long); bulblets 1 to 4 beneath the surface; basal leaf 4 to 6 lines broad, exceeding the inflorescence; bracts linear-lanceolate, long and conspicuous; sepals ovate-lanceolate, greenish-lilac; petals lilac, cuneate, somewhat truncate, denticulate, 10 to 14 lines long, naked above, very sparingly hairy immediately above the gland; gland shallow, convexly crescent-shaped on lower side, truncate above, covered by an appressed lightly fringed scale and with a dense border of hairs above; anthers broadly linear; capsule elliptic.

Low wet valley lands: Mendocino and Lake cos. to Monterey Co. Apr.-May.

Locs.—Ridges west of Hupa, acc. *Tracy*; Round Valley, Mendocino Co., *Westerman*; Sherwood Valley, *Davy & Blasdale*; Kelseyville, *H. Irwin*; Calistoga, *Jepson*; Conn Valley, *Jepson* 6254; Sonoma, *Bioletti*; Pacific Grove, *Heller* 6729.

Refs.—CALOCHORTUS UNIFLORUS H. & A. Bot. Beech. 398, t. 94 (1841), type from Cal., *Douglas*; Hooker, Bot. Mag. t. 5804 (1869); Jepson, Fl. W. Mid. Cal. 112 (1901). *C. lilacinus* Kell. Proc. Cal. Acad. 2:5 (1863), type loc. Calistoga.

24. **C. greenei** Wats. Stem scape-like, 10 to 17 inches high, bearing a 1 to 5-flowered umbel; basal leaf shorter than or equaling the stem, ½ inch broad; bracts narrow; sepals greenish, lilac within, ¾ the length of the petals; petals long fan-shaped, 1 to 1½ inches long, lilac, somewhat barred with yellow below, arched with a shallow gland pocket; pocket partly covered by a very narrow transverse fringed scale, and bordered above by a thick growth of hairs; lower half of petals above the gland with very sparse fine hairs 3 to 4 lines long; anthers oblong, obtuse, 2 lines long; capsule 1 inch long or somewhat shorter, orbicular to elliptic, attenuate into a stout beak, on stout flexuous or strictly erect pedicels.

Wet adobe, Siskiyou Co. to Modoc Co. Fringe of the scale and lower hairs of the border above the gland closely papillate.

Loc.—Forestdale, Modoc Co., *M. S. Baker*.

Ref.—CALOCHORTUS GREENEI Wats. Proc. Am. Acad. 14:264 (1879), type loc. Siskiyou Co., *Greene*.

18. **ERYTHRONIUM** L. ADDER'S TONGUE

Stem short, simple, scapose, from a deep-seated and elongated membranous-coated corm. Leaves 2, basal or nearly so. (Before coming into flower, first or second year, the plants are stemless, producing simply one broad long-petioled leaf.) Flowers large, nodding, solitary, or several and racemose; perianth-segments distinct with longitudinal nectar-bearing groove and 2 or 4 sac-like or bulbous processes at base, or only the inner segments so provided. Stamens 6, hypogynous, shorter than the perianth. Style 3-cleft with 3 stigmas, or entire and stigma 1. Capsule somewhat 3-angled, loculicidal.—Species 12, North America and Europe. (Greek eruthros, red, the color of the flowers in some species.)

In the Erythroniums the bulb (corm) is annual. The bulb produced last summer will this spring develop the stem and leaves; during the summer a new bulb forms by its side, and by autumn the old bulb will have shrunk to a hard knotty scar, attached on the one side to the new bulb and on the other to a chain of like scars, which form a pseudo-rhizome representing the growth of preceding years.—Carl Purdy, Flora & Sylva, 2:250 (1904).

Bibliog.—Watson, S., Revision of the Am. Species of Erythronium (Proc. Am. Acad. 26:126–130,—1891). Baker, J. G., Note on Am. Erythroniums (Gard. Chron. ser. 3, 21:299,—1897). Purdy, C., Erythronium grandiflorum and related species (Gard. & For. 10:157,—1897); Western Erythroniums (Flora and Sylva, 2:250–256,—1904).

Inner perianth-segments without auricles or scales; flowers solitary or racemose............ 1. *E. purpurascens.*
Inner perianth-segments with auricles and a median pair of sacs, each joined laterally to the auricle by a narrow ridge or saccate process.
  Scape bearing a solitary flower or when several the pedicels often very long or unequal.
    Flowers purple; pedicels often very unequal, half to as long as the scape............ 2. *E. hendersonii.*
    Flowers mostly cream, yellow or pink.
      Filaments filiform or very narrowly dilated.
        Style and stigma entire............3. *E. citrinum.*
        Style 3-cleft or 3-lobed at apex.
          Leaves bright solid green............4. *E. grandiflorum.*
          Leaves strongly mottled............5. *E. californicum.*
      Filaments ovately scarious-winged............6. *E. revolutum.*
  Scape none, the flowers 1 to 5 in an umbel sessile between the leaves, each flower thus raised on a scape-like pedicel............7. *E. hartwegii.*

1. **E. purpurascens** Wats. Three to 6 (or 16) inches high, the scape bearing 1 to 8 flowers in a raceme, the flowers commonly approximate, rarely with very unequal pedicels and umbellate; leaves not mottled, undulate-margined, dark metallic green; flowers light yellow, tinged purple after a few days, the linear segments 7 to 8 lines long, only slightly recurved; filaments filiform; style clavate, shorter than the stamens, its stigma obscurely lobed.

Sierra Nevada, Mt. Lassen to Tulare Co., brushy or forested slopes, 4000 to 8000 feet. Rare south of Plumas Co. June-July.

Locs.—Hot Springs Valley near Lassen Peak, *Jepson* 4079 (lower part of petals sulphur yellow, the upper part pure white and fading pink); Big Mdws., Plumas Co., *R. M. Austin*; Cisco, acc. *Purdy*; Mt. Moses, *Purpus*.

Refs.—ERYTHRONIUM PURPURASCENS Wats. Proc. Am. Acad. 12:277 (1877). *E. grandiflorum* var. *multiflorum* Torr. Pac. R. Rep. 4:146 (1857), type loc. Downieville, *Bigelow*. *E. purpurascens* var. *uniflorum* Wats. Bot. Cal. 2:171 (1880), resting on *E. grandiflorum* Torr. Pac. R. Rep. 4:145 (1857), type loc. Forest City near Downieville, *Bigelow*.

2. **E. hendersonii** Wats. Seven to 12 inches high, 1-flowered or with 2 to 4 flowers on pedicels half to as long as the scape; leaves mottled, long-oblong, obtuse or obtusish, or tapering from the middle upward; perianth purple, the segments very revolute, 1¼ to 1⅜ inches long, the base of segments with a median pair of inflated or bulbous sacs, each connected with the auricles by a small sac or papilla; stigma 3-lobed.

Siskiyou Co. North to southwestern Oregon.

Locs.—Quartz Valley, *Butler*. Grants Pass, Ore., *M. S. Baker*.

Ref.—ERYTHRONIUM HENDERSONII Wats. Proc. Am. Acad. 22:479 (1887), based on Oregon spms. (Ashland, *Henderson*, and Grants Pass, *Howell*).

3. **E. citrinum** Wats. Scape 1 to 3-flowered, 5 to 11 inches high; leaves "mottled," but not obviously so in our material, oblong, obtuse or acute, more or less undulate, 3 to 6 or 10 inches long; flowers lemon-yellow, the oblong acuminate segments 1 to 1¼ inches long; inner perianth-segments bearing at base a median pair of saccate protuberances, each joined laterally by a smaller sac or process to the auricle; style clavate at apex; style and stigma quite entire.

Open pine woods, central Sierra Nevada and southwestern Oregon. Apr.

Tax. Note.—Watson describes the appendages as "scales," but in dried specimens these "scales" of the delicate perianth segments are portions of the formerly open sacs flattened by pressure.

Locs.—Italian Bar, Tuolumne Co., *Fred Grant*; Yankee Hill, *Jepson* 6407.

Ref.—ERYTHRONIUM CITRINUM Wats. Proc. Am. Acad. 22:480 (1887), type loc. Deer Creek Mts., Josephine Co., Ore., *Howell*.

4. **E. grandiflorum** Pursh var. **parviflorum** Wats. Scape 1 to 2 or 5-flowered; leaves bright green, without spots; flowers egg-yellow, at higher altitudes lemon-yellow; inner perianth-segments auricled and with 4 equal sacs at base, the sacs ridged, wrinkled or flattened and not very distinct from each other; style 3 cleft at apex or merely 3-lobed.

High montane in northern Humboldt Co. and in Siskiyou Co. North to British Columbia.

Locs.—Trinity Summit, *Jepson*, 2039; Marble Mt., *Jepson* 2826.

Refs. ERYTHRONIUM GRANDIFLORUM Pursh, 1:231 (1814), type loc. Kamiah, Ida., *Lewis*; var. PARVIFLORUM Wats. Proc. Am. Acad. 26:129 (1891), based on high montane spms. from the western U. S. *E. parviflorum* Gooding, Bot. Gaz. 33:67 (1902).

5. **E. californicum** Purdy. FAWN LILY. Like preceding but leaves strongly mottled; flowers creamy white or somewhat yellowish, or white; median sacs 2, the lateral ones reduced to a transverse ridge.

Brushy or open hillslopes: northern Sonoma Co. to Humboldt and Trinity cos., 500 to 3500 feet. Mar.-Apr.

Locs.—Gualala River, *M. S. Baker*; Cloverdale, *Setchell*; Middletown grade, *Jepson*; Willits, *W. C. Mathews*; Blue Rock Ridge, *Jepson* 1880; Harris, *Ethel Tracy*; Kneeland Prairie, *Tracy* 4897 (flowers white); Burnt Ranch, acc. to *Purdy*.

Refs.—ERYTHRONIUM CALIFORNICUM Purdy, Flora and Sylva, 2:253 (1904), type loc. Ukiah, *Purdy*. *E. grandiflorum* Wats. Bot. Cal. 2:170 (1880), not Pursh. Purdy's species seem insufficiently distinct from the northern plant usually called E. giganteum Lindl. (Bot. Reg. sub. t. 1786,—1836, type loc. "Northwest America," *Douglas*), but he restricts the true E. giganteum to the region from Grants Pass, Ore., north to British Columbia.

E. HOWELLII Wats. Proc. Am. Acad. 26:130 (1891). Flowers light yellow, in age pale rose, "without auricles or scales."—Type loc. Waldo, Ore., *Howell*. Specimens of both Howell's first and second distribution show auricles and sacs ("scales"). On the other hand Purdy states that specimens from the Adams Mine 1 mile sw. of Waldo, probably the exact type station, are "entirely destitute of appendages."

6. **E. revolutum** Sm. Like E. californicum; scapes 1 or 2 (to 4)-flowered, 7 to 12 inches high; leaves lightly mottled; flowers bright pink or pale lavender, sometimes white, aging to purple; filaments broadly dilated, almost conniving around the ovary.

Woods, often on borders of swamps: Mendocino and Humboldt cos., 10 to 20 miles from the coast, 500 to 2500 feet. Northward to British Columbia.

Locs.—Navarro River, acc. *Purdy*; Kneeland Prairie, *Tracy* 3183, 4059, 4896; High Prairie, Bald Mt., *Tracy* 4938; Hupa, *Chandler* 1279.

Refs.—ERYTHRONIUM REVOLUTUM Smith, Rees' Cycl. 13. no. 3 (1809), type loc. Gulf of Georgia, British Columbia, *Menzies*. Var. *bolanderi* Wats. Proc. Am. Acad. 26:129 (1891), type loc. Mendocino redwoods, *Bolander*.

7. **E. hartwegii** Wats. Flowers solitary or borne in a 2 to 5-flowered umbel sessile between the pair of basal leaves, each flower thus appearing to be raised on a scape of its own; scape-like pedicels 3 to 6 inches high; corms forming offsets freely at the end of filiform filaments originating from their base; leaves richly mottled; flowers white or cream with orange or yellow base; inner perianth-segments with a median pair of compressed sacs and with prominent auricles; stigma 3-lobed or -parted.

Brushy hillsides: Sierra Nevada foothills, Tehama Co. to Mariposa Co. Apr. Our only species which has offsets.

Locs.—Rough and Ready, Nevada Co., *Jepson*; Auburn, *Bolander*; Mariposa, *Congdon*.

Refs.—ERYTHRONIUM HARTWEGII Wats. Proc. Am. Acad. 14:261 (1879), resting first on *E. grandiflorum* Benth. Pl. Hartw. 339 (1857), type loc. Sierra Nevada foothills in Tehama Co., near Pine Creek, *Hartweg* 288.

19. **FRITILLARIA** L.

Stem erect, simple, from a bulb of one or few thick fleshy scales. Cauline leaves alternate or whorled, narrow, sessile; basal leaves large, ovate or elliptic, borne only in the year or years before the flowering stalk appears. Flowers in racemes or solitary, dull purple, brownish, whitish or red. Perianth campanulate to funnel-form, deciduous, of 6 distinct segments, each segment usually with a shallow gland or nectar-bearing area above the base. Stamens 6, inserted on the base of the segments, included; filaments slender; anthers extrorse, more or less versatile. Ovary sessile or nearly so. Style 1, entire or 3-parted. Capsule membranous, 6-angled or winged, loculicidally 3-valved. Seeds numerous, in 2 rows in each cell.—About 50 species, northern hemisphere. Our species bear a minute tuft of glandular hairs at apex of the perianth-segments. (Latin fritillus, a dice-box, on account of the shape of the flower.)

A. Style entire (or 3-parted at the very apex in no. 3); perianth of uniform color, its glands obscure.

Flowers yellow; plants 3 to 9 inches high........1. *F. pudica.*
Flowers pink or pink-purple.
Perianth ¾ to 1 inch long; plants 10 to 30 inches high........2. *F. brandegei.*
Perianth 1 to 1⅜ inches long; plants 6 to 12 inches high........3. *F. pluriflora.*

B. Style deeply 3-cleft; perianth-glands mostly obvious.

Stem leafy only on lower half, the larger leaves mostly basal; odor often obnoxious; perianth evenly shaded, not mottled or checkered (except no. 6).
Stem 3 to 12 inches high.
Flowers dull white........4. *F. liliacea.*
Flowers not white.
Flowers dark brownish or greenish purple........5. *F. biflora.*
Flowers shaded with pink, checkered purple........6. *F. purdyi.*
Stems 12 to 20 inches high; flowers yellowish green........7. *F. agrestis.*

Stem leafy above, the lower half or third naked.
Perianth evenly shaded, not mottled or checkered, at least not commonly.
Flowers more or less purplish or greenish, often lighter within; segments obovate-oblong........8. *F. parviflora.*
Flowers green; segments lanceolate........9. *F. viridia.*
Perianth mottled or checkered.
Flowers scarlet; style cleft ⅙ to ⅕ its length........10. *F. recurva.*
Flowers brownish purple; style cleft to below the middle.
Leaves ovate-lanceolate; perianth-segments 1 to 1½ inches long........11. *F. lanceolata.*
Leaves linear; perianth-segments ½ to ¾ inch long.
Stem slender or equably developed in proportion to the leaves; capsule acutely angled........12. *F. atropurpurea.*
Stem stout, much thickened in proportion to the leaves; capsule with horn-like processes at the base and summit of each valve........13. *F. pinetorum.*

1. **F. pudica** Spreng. YELLOW FRITILLARY. Stem 3 to 9 inches high, 1 to 3-flowered; bulb-scales very small and rounded; leaves 3 to 8, narrowly oblanceolate, alternate, borne generally on upper half of stem; perianth yellow or orange, often purple tinged outside, the segments oblong-obtuse to obovate-oblong, 5 to 9 lines long, the glands at base very small; stigma very shortly 3-lobed; capsule obovoid-oblong, ⅔ inch long.

Sierra Co. to Siskiyou Co., mostly east and north of the Sierra Nevada crest, 5000 to 6000 feet. North to British Columbia, east to Utah. Apr.-May. Flowers turning brick-red and recurving in age.

Locs.—Mohawk Valley, *Minor*; Rocky Comfort School, nw. Lassen Co., *Louise Scroggin*; Lassen Creek, *R. M. Austin*; Alturas, *Goldsmith* 48; Ft. Bidwell, *Manning*; Rhett Lake, *Manning*; Goose Valley, Shasta Co., *M. S. Baker*; Yreka, *Butler* 1121; Fort Jones, *Anna Conan.*

Refs.—FRITILLARIA PUDICA Spreng. Syst. 2:64 (1825); Baker, Journ. Linn. Soc. 14:267 (1874). *Lilium? pudicum* Pursh, Fl. 1:228, t. 8 (1814), type loc. headwaters Missouri River, *Lewis.*

2. **F. brandegei** Eastw. Stem stout, glabrous, 10 to 30 (?) inches high, about 7-flowered; leaves on upper half of stem, in 2 whorls of 5 to 9, oblong-lanceolate, 3 to 4 inches long, ½ to ¾ inch wide; flowers pinkish or purplish, campanulate with obtuse base, borne on recurved rather thick pedicels; perianth-segments ¾ to 1 inch long, oblong-lanceolate, becoming involute and spreading; glands obscure; filaments subulate; style exceeding the stamens, entire, with stigma scarcely lobed; capsule winged, truncate.

In the Yellow Pine belt, Tule River basin, 5000 feet. Insufficiently known.

Loc.—Bear Creek, Tulare Co., *Purpus.*

Ref.—Fritillaria brandegei Eastw. Bull. Torr. Bot. Club 30:484 (1903), type loc. Coburn Mill, Bear Creek, on North Fork, Tule River, *T. Brandegee.*

3. **F. pluriflora** Torr. Adobe Lily. Stems 6 to 12 inches high, leafy chiefly at base, 1 to 7-flowered; bulb somewhat yellowish, its scales few (6 to 8), $\frac{1}{2}$ to 1 inch long; leaves 4 to 10, oblong-lanceolate; perianth uniform pink-purple, the segments obovate-oblong, acutish, 1 to $1\frac{3}{8}$ inches long; style 3-parted at apex; capsule as broad as long, truncate at apex, narrowed toward the base, strongly 3-lobed, each lobe with 2 longitudinal dorsal ridges or wings with intervening depression.

Adobe soil in the foothills bordering the Sacramento Valley: Solano, Yolo and Butte cos. Feb.-Mar. Also called Pink Fritillary.

Locs.—Vacaville, *Jepson* 5303; Sweeney Creek, Solano Co., *R. H. Platt*; Clear Creek, Butte Co., *H. E. Brown* 141.

Refs.—Fritillaria pluriflora Torr.; Benth. Pl. Hartw. 338 (1857), based on *Fremont* 313 (Feather River) and *Hartweg* 258 (Sierra foothills, n. Butte Co.); Jepson, Fl. W. Mid. Cal. 107 (1901).

4. **F. liliacea** Lindl. White Fritillary. Stem 3 to 10 (or sometimes 12) inches high, often somewhat stout and succulent, 1 to 5-flowered; leaves of the basal tuft linear to oblong-lanceolate, $\frac{1}{4}$ to $\frac{3}{4}$ inch broad, $1\frac{1}{4}$ to $4\frac{1}{2}$ inches long, the cauline leaves few, linear-oblong or linear; flowers dull white; perianth-segments oblong-ovate to obovate, 6 to 9 lines long; gland greenish, purplish-dotted, the greenish veins sometimes glandular nearly or quite to the apex of the segments; style cleft to about the middle; capsule stipitate, truncate at each end, $\frac{1}{2}$ inch long and as broad, the back of each lobe slightly channeled and 2-ridged.

Open hilltops near the coast from San Francisco Bay to Monterey Co. Mar.-Apr.

Locs.—Pfeifer's Pt., Monterey coast, *Marion Parsons*; Carmel Bay, *F. G. Woodcock* (odor disagreeable like F. agrestis); Redwood City, *Jepson* 5732; Hillsboro, *Inez Smith*; Potrero Hills, San Francisco, *Dunn* (dwarfed); San Leandro, *A. E. Wieslander*; Stege (*Davy* 6530) and Point Richmond (*Tracy* 612), growing in low ground, tall, succulent, with narrow leaves.

Refs.—Fritillaria liliacea Lindl. Bot. Reg. sub t. 1663 (1835), type from Cal., *Douglas;* Jepson, Fl. W. Mid. Cal. 109 (1901).

5. **F. biflora** Lindl. Mission Bells. Stem stout, 4 to 10 (rarely 12) inches high, 2 to 4 (rarely 1, less rarely as many as 7)-flowered; leaves 2 to 7, scattered or somewhat whorled below, oblong to ovate-lanceolate, 2 to 4 inches long, $\frac{1}{4}$ to $1\frac{1}{4}$ inches wide; perianth campanulate, 8 to 12 lines long, dark brownish or greenish-purple; segments oblong-lanceolate, with a longitudinal greenish glandular band extending from the base nearly to the apex; style cleft to about the middle; capsule nearly 1 inch broad, and not quite as high.

Southern California (cismontane region) northerly to San Luis Obispo Co.; apparently localized also in the North Coast Ranges. Also called Chocolate Lily and Black Lily.

Locs.—San Diego, *Cooper;* Winchester, Riverside Co., *Hall* 384; San Dimas, *Chandler*; Los Angeles, *C. J. Fox*; San Luis Obispo, *J. A. Metzler*; (?) Ukiah, *Bolander.*

Var. **inflexa** Jepson n. var. Longitudinal band much thickened at apex, especially on the inner perianth-segments and inflexed in such a way as to form a channel at apex on the back of the segments.—(Segmenta perianthii virga media ad apicem crassiore, inflexa.)—Palisades region, Calistoga, *Elizabeth C. Wright* (type). Var. **ineziana** Jepson n. var. Stem slender, 1 or 2-flowered; leaves linear-oblong to lanceolate, 2 to 3 inches long, 2 to 4 lines wide; perianth segments widely spreading, often faintly mottled with yellow; odor very disagreeable.—(Caulis tenuis, 1–2-floribus; folia lineari-oblonga vel lineari-lanceolata; odor nauseosus.)—San Mateo Co.: Hillsboro, *Inez Smith* (type). Intermediate between the species and F. purdyi. Also closely allied to F. liliacea.

Refs.—Fritillaria biflora Lindl. Bot. Reg. sub t. 1663 (1835), type from Cal., *Douglas.* *F. lanceolata* Torr. Bot. Mex. Bound. pl. 61 (1859). *F. succulenta* Elmer, Bot. Gaz. 41:311

(1906), type loc. Hernandez, San Benito Co., *Laura M. Lathrop*; leaves succulent, covered with a bloom.—Ex. char. Var. inflexa Jepson. Var. ineziana Jepson.

6. **F. purdyi** Eastw. Stem 4 to 9 inches high, 1 to 7-flowered; basal leaves ovate to oblong, obtusish, 1¼ to 2¼ inches long, the upper linear; flowers white and purple mottled, shaded with pink; style cleft about to the middle.

Humboldt and Trinity cos.

Loc.—Lewiston, *Wendell Philips*.

Ref.—Fritillaria purdyi Eastw. Bull. Torr. Bot. Club 29:75, pl. 6 (1902), type loc. Kneeland, Humboldt Co., *C. Lowe*.

7. **F. agrestis** Greene. Stink Bells. Stem from very deep-seated bulb, 12 to 20 inches high, leafy on the lower half; leaves 8 to 12, oblong-oblanceolate to linear-lanceolate, alternate or the lower somewhat whorled; raceme 3 to 8-flowered, the flowers exactly campanulate, nodding on pedicels abruptly recurved at summit; perianth-segments 1 to 1¼ inches long, 4 to 5 lines wide; yellowish green, with prominent or ligulate green band running nearly to the apex, distinctly glandular at base, and more or less glandular above; style cleft to about the middle.

Grain fields, region of the lower San Joaquin and Sacramento rivers. Odor very obnoxious.

Locs.—Turlock, comm. *Edith M. Wickes*; e. side of Mt. Diablo, *Linda Gehringer*; Antioch, *Davy* 987; Sacramento Co., *J. Durham* (1-flowered dwarf).

Refs.—Fritillaria agrestis Greene, Erythea 3:67 (1895), type loc. Antioch, *Greene*; Jepson, Fl. W. Mid. Cal. 109 (1901).

8. **F. parviflora** Torr. Brown Bells. Stem 1¼ to 2½ feet high; bulb with numerous rice-grain bulblets; leaves linear to linear-lanceolate, 2½ to 4 inches long, 3 to 4 lines wide, borne on the upper half of the stem, the lower ones 3 to 5 in a whorl, the upper whorled or alternate; raceme long, with 4 to 10 campanulate flowers on short recurved pedicels; perianth 4 to 6 lines long, purplish or greenish white to greenish purple, often lighter inside, rarely faintly mottled, the veins evident, darker; segments obovate-oblong, obtuse to acuminate, with oblong-lanceolate glands on lower third; stamens with subulate filaments, ⅔ as long as the segments and a little shorter than the style; style cleft ⅓ to ⅔ its length, the terminal flowers often (or occasionally several or all the flowers) with pistil less than half developed; ovary and capsule broadly winged.

Pine woods: Sierra Nevada from Yuba Co. to Tulare Co., 1500 to 3900 feet; occasional in the inner Coast Range.

Locs.—Sierra Nevada: Penn Valley, Nevada Co., *Jepson*; Squaw Valley, Placer Co., *L. S. Smith*; New York Falls, Amador Co., *Hansen* 51; Avery, Calaveras Co., *A. L. Grant*; Gwin Mine, Calaveras Co., *Jepson* 1788; Yankee Hill, Tuolumne Co., *Jepson* 6404; Kinsley, Mariposa Co., *Charlotte Hoak*; Sequoia Mills (Millwood), *Eastwood*; Marble Fork, Kaweah River, *Hopping* 303. Coast Ranges: Hollister, *Bettys*; Mt. Diablo, *Jepson* 7573.

Refs.—Fritillaria parviflora Torr. Pac. R. Rep. 4:146 (1857), type loc. Murphy's, Calaveras Co., *Bigelow*. Not *F. parviflora* Mart. (1838). *F. micrantha* Heller, Muhl. 6:83 (1910).

9. **F. viridia** Kell. Stem 8 to 20 inches high, 3 to 6-flowered; bulb ¼ to ½ inch in diameter, its scales round and thick; leaves lance-linear, subacute, 1½ to 2½ inches long in 1 or 2 whorls on the upper half of the stem; flowers pendent on short pedicels, pale green to almost black, campanulate, 5 to 7 lines long; perianth-segments lanceolate, somewhat chartaceous; gland dark green, lanceolate, extending from the base and continued less distinctly to the apex, or quite obscure; apical tuft of hairs short, dense, white, glandular; anthers minutely but distinctly mucronate; style 3-cleft to about the middle; ovary cylindrical, acutely angled; capsule not seen.

San Carlos Range. A local and long-neglected species, but perhaps too near the preceding.

Loc.—San Benito Peak, *Jepson* 2714.

Ref.—Fritillaria viridia Kell. Proc. Cal. Acad. 2:9 (1863), type loc. New Idria, *Veatch*.

10. **F. recurva** Benth. Scarlet Fritillary. Stem stout, 18 to 30 inches high; bulb large and flattish, its scales numerous and thick, with rice-grain bulblets at base; leaves in 2 or 3 whorls near the middle of the stem, linear to linear-lanceolate, 2 to 6 lines broad; flowers 3 or 4 (to 6); perianth campanulate-funnelform, 1 to 1½ inches long, scarlet-checked upon yellow, the scarlet becoming crimson and purple in old flowers, the segments recurving strongly at the tips; gland oblong, 3 lines long, slightly depressed; style slender, 3-cleft ⅙ to ⅕ its length.

Northern Sierra Nevada (Placer Co. northerly to Modoc Co.); Coast Ranges (Mendocino Co. to Siskiyou Co.). North to Oregon.

Locs.—Butterfly Valley, Plumas Co., *R. M. Austin* 303; Hatchet Creek, Shasta Co., *Baker & Nutting*; Modoc. Co., *M. S. Baker*; Yreka, *Butler* 1191; Sisson, *L. S. Smith*; Buck Mt., *Tracy* 4176; Round Valley, *Westerman;* Long Valley, *Bolander* 4708.

Var. **coccinea** Greene. Stems commonly more slender, 10 to 20 (or 30) inches high, 1 to 3 (or 5) -flowered; bulb small, higher than thick, its scales 2 to several; flowers scarlet, mottled with yellow; segments with tips generally not recurved.—Hoods Peak and Napa ranges; north to eastern Mendocino Co.: Middletown grade, Mt. St. Helena, *Jepson*; St. Helena, *Jepson*; Red Mt., se. of Ukiah, acc. Purdy; Eden Valley, acc. Purdy.

Refs.—Fritillaria recurva Benth. Pl. Hartw. 340 (1857), type loc. Sierra Nevada foothills, n. Butte Co., *Hartweg* 294; Baker, Bot. Mag. t. 6264 (1876). Var. coccinea Greene, Pitt. 2:230 (1892), type loc. Hoods Peak, Sonoma Co., *Bioletti*. *F. coccinea* Greene, l.c. 250.

11. **F. lanceolata** Pursh. Checker Lily. Stem 1½ to 2 (or 3) feet high; scales few or none, the lower portion of the solid bulb covered with numerous rice-grain bulblets; leaves 6 to 10 in 2 or 3 whorls on the upper part of the stem, ovate-lanceolate, 2 to 4 inches long; raceme 1 to 4, sometimes to 13-flowered; perianth deeply bowl-shaped, 1 to 1½ inches long, dark purple mottled with greenish yellow, the segments ovate to oblong, deeply concave, with a very large ovate-lanceolate gland in the middle of the concavity; gland deep green, sharply defined, often with minute black dots; style cleft to below the middle; capsule broadly winged, ⅔ inch long.

Near the coast, on oak-covered or brushy hills: San Mateo Co. north to Humboldt Co. Northerly to British Columbia and Idaho. Also called Rice-root Lily.

Locs.—Lake Pilarcitos, *Davy* 1056; San Francisco, *A. L. Grant;* Inverness, *Jepson* 502b; Long Valley, Mendocino Co., *Bolander* 4707; Kneeland Prairie, *Tracy* 2640; Eureka, *Tracy* 4419; Hupa, *Manning;* Quartz Valley, Siskiyou Co., *Butler* 1225.

Var. **floribunda** Benth. Raceme 2 or 3 to several flowered; perianth campanulate, purple or greenish, conspicuously spotted or checkered, 6 to 13 lines long; segments broadly oblong or narrowly ovate, crisped or erosulate-margined, the outer often broader; gland greenish, extending from the base ½ or ⅔ the way to the apex.—Shady woods, Coast Ranges from Santa Clara Co. north to Lake Co.

Locs.—Loma Prieta, *Davy* 671; Los Gatos, *Heller* 7271; Crystal Springs Lake, *C. F. Baker* 430; Livermore Valley, *Hall* 1629; Grizzly Peak, *Davy* 118; Mt. Tamalpais, *Chandler* 275; Santa Rosa, *M. S. Baker* 722; Glen Ellen, *M. L. Douglass*; Vaca Mts., *Jepson*; Middletown grade, Mt. St. Helena, *Jepson*; Kelseyville, *Irwin* 101.

Var. **gracilis** Wats. Flowers smaller than the last, with narrow and more acuminate segments; stamens short and anthers often small.—Marin Co. to Napa Co.: Angel Isl., *F. P. McLean*; Napa Range near Calistoga, *Jepson*.

Var. **tristulis** A. L. Grant n. var. Perianth scarcely mottled, gland black-purple, not dotted. —Near the coast in Marin Co., *A. L. Grant* (type).

Refs.—Fritillaria lanceolata Pursh, Fl. 230 (1814), type loc., headwaters of the Columbia River, *Lewis*; Jepson, Fl. W. Mid. Cal. 108 (1901). Var. floribunda Benth. Pl. Hartw. 338 (1857). *F. mutica* Lindl. Bot. Reg. sub t. 1663 (1835), type from Cal., *Douglas*; Jepson, Fl. W. Mid. Cal. l.c. *F. lanceolata* Hook. Fl. Bor. Am. 2:181 t. 193 (1839), not Pursh. Var. gracilis Wats. Proc. Am. Acad. 14:259. *F. lanceolata* var.(?) Benth. Pl. Hartw. 340 (1857), type loc. Corte Madera, *Hartweg* 218. *F. mutica* var. *gracilis* Jepson l.c. Var. tristulis A. L. Grant.

12. **F. atropurpurea** Nutt. Stem ½ to 1½ feet high from a thick-scaled bulb; leaves 7 to 14, on the upper half of the stem, alternate or more or less whorled, narrowly linear, sessile, 2 to 4¼ inches long; flowers open-campanulate, 1 to 4 (rarely 5 or 6) on recurved pedicels; segments purplish-brown mottled with yellowish-green, narrowly rhombic or oblong and tapering to base and apex, ½ to ¾ inch long; style cleft ¾ its length; capsule acutely angled.

High North Coast Ranges, Sierra Nevada and San Bernardino Mts., 6000 to 10,500 feet; northerly to Oregon and Montana.

Locs.—Salmon Summit, *Jepson* 2077; Dorleska, Trinity Co., *Hall* 8574; Marble Mt., *Jepson* 2831; Humbug Mt., *Butler* 1261; Modoc Co., *M. S. Baker*; Mt. Lassen, *Hall & Babcock* 4301; Mt. Lyell, *Hall & Babcock* 3562; Marble Fork, Kaweah River, *Hopping*; San Bernardino Mts., acc. *Parish* (Pl. World, 20:209). A dwarf form is the var. **falcata** Jepson n. var. Three inches high; leaves mostly basal, broadly linear, falcate; flowers 2 or 3.—(Unc. 3 alta; folia plerumque basalia, late linearia, falcata; flores 2 vel 3.)—San Carlos Range (San Benito Peak, *Jepson* 2715, type).

Refs.—FRITILLARIA ATROPURPUREA Nutt. Journ. Acad. Phila. 7:54 (1834), type loc. Flathead River, n. Rocky Mts., *Nuttall*. Var. FALCATA Jepson.

13. **F. pinetorum** Davidson. Stem stout or even somewhat fistulous, 5 to 14 inches high; bulb with numerous rice-grain bulblets; leaves 12 to 20, approximate in somewhat indefinite whorls, linear, noticeably narrow in contrast to the stoutness of the stem; flowers 3 to 8, on upright pedicels slightly flexuous at first but becoming stout and stiff; segments dark greenish purple and yellow, mottled, broadly ovate-acuminate, obtuse at very apex, about ½ inch long; gland indefinite; filaments narrowly subulate; style 3-cleft half its length or more; capsule acutely angled with short horn-like processes at the base and summit of each valve.

Pine forests, 6000 to 9000 feet: White Mts. and southern Sierra Nevada southerly to the San Gabriel and San Bernardino mts.

Locs.—Campito Mt., *Jepson* 7292; Casa Diablo, Owens Valley, *Almeda Nordyke;* Long Mdw., North Fork Kings River, *Hall & Chandler* 442½; Kern Peak, *Mary Haskell*; Mt. Pinos, *Hall* 6517; Swartout Cañon, Mt. San Antonio, *Hall* 1507.

Ref.—FRITILLARIA PINETORUM Davidson, Muhl. 4:67 (1908), type loc. Mt. Cummings, Kern Co., *Hasse & Davidson* 1739.

20. **LILIUM** L. LILY

Stems simple, tall and leafy, from a scaly bulb or scaly rootstock. Leaves narrow, sessile. Flowers large and showy, solitary or 2 to many in a terminal raceme. Perianth most commonly funnelform; its segments 6, yellow, red or white, often dotted or spotted with brown, distinct, equal, spreading or recurved, with a nectar-bearing groove toward the base. Stamens 6, hypogynous, included; anthers versatile. Style one, long, deciduous; stigma 3-lobed. Capsule loculicidal; seeds numerous, flat, horizontal, in 2 rows in each cell. —Species about 45, north temperate zone. (Greek lilion, the classical name.)

Lilies inhabiting dry slopes do not have jointed scales, while jointed scales characterize the wet land species. Lilies in cold or shaded places do not perfect as much seed as in opener spots but the joints of the bulb-scales are wonderfully adapted to propagation. If a jointed bulb is disturbed it replants itself many-fold (Carl Purdy).

Bibliog.—Elwes, H. J., Monog. of the Genus Lilium (1880). Purdy, C., Pacific Coast Lilies (Gard. & For. 10:43, 144, 326,—1897); New West American Lilies (Erythea, 5:103–105,—1897); Lilies of the Western U. S. and British Columbia (Jour. Roy. Hort. Soc. 26:351–362, figs. 183–186,—1904). Hansen, Geo., Lilies of the Sierra Nevada (Erythea 7:21–23,—1899). Waugh, F. A., Conspectus of the Genus Lilium (Bot. Gaz. 27:235–254, 340–360, figs. 1–14,—1899).

A. Plants of dry places with true bulbs (not rhizomatous); bulb-scales not jointed.

Flowers white (aging purplish or rose-purple) or pink.

Perianth pure white or minutely purple-dotted, aging purplish, 3 to 4 inches long, its segments slightly recurved at tip........................1. *L. washingtonianum*.

Perianth nearly white, brown-dotted, aging rose purple, 1½ to 2 inches long, its segments recurving from the middle........................2. *L. rubescens*.

Perianth pink, its segments revolute to the stem........................3. *L. kelloggii*.

Flowers not white.
  Perianth dark brownish-red to dingy purple.......................4. *L. bolanderi.*
  Perianth orange or yellow.
    Leaves undulate; perianth-segments $2\frac{1}{2}$ to 4 inches long, recurved $\frac{3}{4}$ their length........ 5. *L. humboldtii.*
    Leaves plane; perianth-segments $1\frac{1}{4}$ to 2 inches long, recurved $\frac{2}{3}$ their length................ 6. *L. columbianum.*

B. Plants of bogs or wet places; bulb rhizomatous, its scales jointed.

Flowers red or orange.
  Flowers dark red, purple-spotted within, tips of segments recurved; rhizome not branching 7. *L. maritimum.*
  Flowers orange-red or orange-yellow, dotted or spotted with dark purple.
    Rhizome not branching.
      Upper $\frac{2}{3}$ of perianth-segments at length recurving to the pedicel; scales 1 or 2-jointed.......................8. *L. occidentale.*
      Perianth-segments recurving only at tip; scales 3 or 4-jointed............9. *L. parvum.*
    Rhizome commonly branching, its scales commonly 2-jointed; perianth-segments fully revolute.......................10. *L. pardalinum.*
Flowers clear lemon-yellow; rhizome not branching, its scales 3 or 4-jointed........11. *L. parryi.*

1. **L. washingtonianum** Kell. Washington Lily. Stem commonly 4 to 6 feet tall, the bulb ovate, scales not jointed; flowers pure white, often minutely purple-dotted, aging purplish; perianth tubular-campanulate, 3 to 4 inches long, the segments spreading above, not closely approximate in a tube; stamens a little shorter; anthers yellow, 5 to 6 lines long; capsule obovate-oblong, truncate, obtusely 6-angled or sometimes narrowly winged.

Central and northern Sierra Nevada, 3000 to 6000 feet, in the upper pine forests or in thickets, north to Mt. Shasta, thence westerly to northeastern Humboldt Co. Oregon. Aug. Flowers delightfully fragrant with the odor of pinks.

Locs.—Dinkey Grove, Fresno Co., *A. L. Grant* 1186; Yosemite Park, *Jepson* 4643 (Crane Creek), 3494 (Merced Big Trees); Sierraville, *Alma Ames* 6; Mt. Shasta, *Jepson*; South Fork Mt., Humboldt Co., acc. *Drew*; Bald Mt., Humboldt Co. (purple-tinted), acc. *Purdy*. Not reported from the southern Sierra Nevada, and probably does not occur in Southern California or the South Coast Ranges.

Refs.—Lilium washingtonianum Kell. Proc. Cal. Acad. 2:13 (1863), type from the Sierra Nevada, *Kellogg*, who named it in honor of Martha Washington as "Lady Washington Lily"; Elwes, Monog. Lil. pl. 10 (1880); Drew, Bull. Torr. Club, 16:148 (1889). Var. *purpureum* Baker, Jour. Linn. Soc. 14:233 (1874), type from Yosemite, is the not uncommon purple-tinted form acc. Purdy.

2. **L. rubescens** Wats. Chaparral Lily. Stem 2 to 5 feet high; bulbs ovoid, rhizomatous, the scales not jointed; leaves broadly oblanceolate or obovate, mostly acute, 5 to 10 in a whorl, or the lower scattered; flowers several, nearly white, somewhat dotted with brown, aging to rose-purple; segments $1\frac{1}{2}$ to 2 inches long, the upper $\frac{1}{3}$ revolute; capsule obovoid with subtruncate apex and abruptly short-attenuate base, wing-angled, $1\frac{3}{4}$ inches long.

Chaparral slopes in the Coast Ranges, Santa Cruz Co. to Siskiyou Co. Near the coast called Redwood Lily; towards the interior Chaparral or Chamise Lily.

Locs.—Santa Cruz Mts., *Jepson*; Howell Mt.; Comptche, *H. A. Walker* 275; Kenny's, *Jepson* 2157; Bald Hills, near Hupa, *Manning* 319; Salmon Summit Trail, *Jepson* 2091.

Refs.—Lilium rubescens Wats. Proc. Am. Acad. 14:256 (1879); Jepson, Fl. W. Mid. Cal. 110 (1901). *L. washingtonianum* var. *purpureum* Masters, Gard. Chron. ser. 2, 2:322, fig. 67 (1874), material from Humboldt Co.; Elwes, Monog. Lil. pl. 11 (1880).

3. **L. kelloggii** Purdy. Bulb like that of L. rubescens; flowers 1 to 15; perianth-segments revolute to the stem, pink, dotted purplish-black or maroon, changing to deeper rosy purple, sometimes with a central line of yellow.

Inner margin of the Redwood belt, northern Mendocino Co. to Del Norte Co. Late June, July.

Locs.—Del Norte Co. (Patrick Creek); Humboldt Co., acc. Purdy; Red Mt., nw. Mendocino Co., *Bolander* (who first discovered it).

Ref.—Lilium kelloggii Purdy, Garden, 59:330 (1901), type loc. Kneeland Prairie. Purdy regards this as the most distinct of the newer lilies.

4. **L. bolanderi** Wats. Stem ½ to 2½ feet high, 1 to 7-flowered; bulb ovate, of numerous lanceolate scales 1 to 1½ inches long; leaves in 3 (or rarely 4) whorls with 1 to 3 smaller alternate leaves below, oblanceolate to obovate, acute to obtusish, 1 to 2½ inches long, ¼ to 1⅛ inches wide, glaucous beneath; flowers horizontal or somewhat nodding, dark brownish-red to lurid purple, becoming somewhat paler, spotted; segments 1¼ to 1¾ inches long, barely recurving.

Dry chaparral hillsides, inside the Redwood belt, Mendocino Co. to Siskiyou Co. Southern Oregon. July.

Locs.—South Fork Smith River, *Jepson* 2891; near Preston Peak, *Jepson* 2886; Siskiyou Mts., *Blasdale* 1073.

Refs.—Lilium bolanderi Wats. Proc. Am. Acad. 20:377 (1885), in reality based solely on material from Siskiyou Mts., *Howell*, acc. *Purdy*, Garden, 59:330 (1901), and distinct from Bolander's Red Mt. plant which is L. kelloggii Purdy.

5. **L. humboldtii** Roezl & Leicht. Humboldt's Lily. Stem commonly 3 to 5 feet high, very stout, its leaves generally purplish and slightly undulate, in 4 to 6 whorls; bulb large, ovoid, more or less oblique, its scales not jointed; flowers large, 2½ to 4 inches long, orange-red, spotted with small maroon or purple spots, the segments strongly recurving.

Open woods in lower Yellow Pine and upper chaparral belts of the Sierra Nevada and cismontane Southern California, 3000 to 6000 feet. Bulb-scales possessing a remarkably bitter principle.

Locs.—Rattlesnake Bar, Eldorado Co., *Sonne*; Jackson, *Hansen*; Tehipite Valley, Fresno Co., *Hall & Chandler* 484; San Bernardino Mts., acc. Parish (Pl. World, 20:208); Fish Cañon, San Gabriel Mts., *Peirson* 515.

Var. **bloomerianum** Jepson n. comb. Bulb scales several-jointed; claws of inner perianth-segments somewhat crested.—Cuyamaca Mts. Var. **ocellatum** Kell. Bulb more globular, its scales several-jointed; leaves brighter green; purple spots of flower margined with red.—Mountains from Santa Barbara to Los Angeles. Santa Rosa Isl.

Refs.—Lilium humboldtii Roezl & Leicht.; Duch. Jour. Soc. Hort. France, ser. 2, 5:43 (1871), type from the Sierra Nevada, *Roezl*, who discovered it on the centenary of the birth of Alexander von Humboldt; Comptes Rendus, 72:558 (1871); Elwes, Monog. Lil. pl. 32 (1880). *L. canadense* var. *puberulum* Torr. Pac. R. Rep. 4:146 (1857), type loc. "between Grass Valley and Downieville," *Bigelow*. Var. bloomerianum Jepson. *L. bloomerianum* Kell. Proc. Cal. Acad. 4:160 (1872), type loc. not known. Var. ocellatum Kell. Proc. Cal. Acad. 5:88 (1873), type loc. Santa Rosa Isl., *Harford*.

6. **L. columbianum** Hanson. Oregon Lily. Stem slender, 2 to 4 feet high; bulb small (1½ to 2 inches in diameter); upper leaves scattered, the lower in whorls; perianth-segments 1½ to 2 inches long, strongly recurved, bright reddish orange, thickly spotted with purple.

Humboldt Co. North to Oregon and British Columbia.

Loc.—N. Humboldt Co., coast district, acc. *Tracy*.

Refs.—Lilium columbianum Hanson; Baker, Jour. Linn. Soc. 14:243 (1874), type from Ore., *Lobb* 350; Elwes, Monog. Lil. pl. 31 (1880). *L. canadense* var. *parviflorum* Hook. Fl. Bor. Am. 2:181 (1839), type loc. Columbia and Willamette rivers, *Douglas, Tolmie*.

7. **L. maritimum** Kell. Coast Lily. Stem 1 to 4 feet high with alternate or rarely whorled leaves; bulb rhizomatous, its scales seldom more than one-jointed; leaves very dark green, narrowly oblanceolate or linear, 1 to 5 inches long and 2 to 7 lines wide; flowers 1 to 5, dark red, funnelform, horizontal on long pedicels; segments barely dotted at base, 1¼ to 1½ inches long, the upper ⅓ somewhat recurved; stamens less than 1 inch long, exceeding the style; capsule subglobose to elliptic-oblong, 9 to 10 lines long.

Low meadows or bogs near the coast from Marin Co. northward to Ten Mile River, Mendocino Co.

Locs.—Havens Neck, *Brandt*; Pt. Arena, *Bioletti*; Noyo River, *Davy* 6569.

Refs.—Lilium maritimum Kell. Proc. Cal. Acad. 6:140 (1876), type loc. California coast near San Francisco; Elwes, Monog. Lil. pl. 12, fig. 1 (1880); Jepson, Fl. W. Mid. Cal. 110 (1901).

8. **L. occidentale** Purdy. Eureka Lily. Stem 2 feet high in open ground or 4 to 6 feet high in thickets; bulb like that of L. maritimum; leaves whorled on the middle of the stem, scattered below, lanceolate, acute; flowers from a few to 15 on strongly divaricate pedicels 3 to 9 inches long, nodding at summit; segments 1¼ to 2½ inches long, recurved for ⅔ their length, varying from dark red to reddish yellow, fading purplish, the lower part commonly orange with purple-black spots; anthers oblong, 2 lines long, dark red.

Near the ocean, northern Humboldt Co. to southern Oregon.

Locs.—Humboldt Co., *Tracy* 4356 (Patrick's Point), 5078 (Humboldt Hill), 3705 (Indianola), 4376 (Korbel); Jones Creek, Del Norte Co., *Jepson* 2894.

Ref.—Lilium occidentale Purdy, Erythea 5:103 (1897), type loc. Humboldt Bay, *Purdy*.

9. **L. parvum** Kell. Small Tiger Lily. Stem 1½ to 7 feet high; rootstock thick and fleshy, not branching, the scales 3 or 4-jointed; leaves lanceolate, 3 to 5 inches long, in whorls or quite scattered; flowers 1 or 2 to very many, small (1 to 1¼ inches long) on erect or ascending pedicels; perianth funnelform, only the tips of the segments spreading, orange-yellow spotted with purple.

Wet places along streams or edges of swamps, Sierra Nevada north to Mt. Shasta, 6000 to 9000 feet. Southern Oregon.

Locs.—Truckee, *Sonne*; Blue Lakes, Amador Co., *Hansen*; Snowdon Ranch, Calaveras Co., *Jepson*; Kennedy Mdws., upper Stanislaus River, *Jepson* 6544, 6545; Pleasant Valley, Tuolumne Co., *Jepson* 3395; Merced Big Trees, *Jepson*; Shaver Mills, Fresno Co., *K. Brandegee.*

Refs.—Lilium parvum Kell. Proc. Cal. Acad. 2:179, fig. 52 (1863); Elwes, Monog. Lil. pl. 30 (1880). *L. canadense* var. *parvum* Baker; Hook. Bot. Mag. t. 6146 (1875).

10. **L. pardalinum** Kell. Tiger Lily. Stem 3 to 5 or even 7 feet high; rootstock thick and fleshy, closely covered with 2-jointed closely overlapping scales, branching and eventually forming large mat-like clusters; leaves in whorls or alternate, linear-lanceolate; flowers 1 to many, racemose or the lower in whorls, on long spreading pedicels; segments 2 to 3 inches long, 6 to 9 lines wide, strongly revolute, bright orange-red with a lighter orange center and large purple spots on the lower half; capsule narrowly oblong, acutely angled, 1½ inches long.

Stream banks and moist hillside meadows: Coast Ranges, at low altitudes near the sea or in the high mountains; Sierra Nevada, 3000 to 4000 feet. Also called Leopard Lily. Bulb-scales sometimes 3-jointed in some forms of it. June–Aug.

Locs.—Shelley Creek, Del Norte Co., *Jepson* 2918; Quartz Valley, *Butler* 1454; Mt. Shasta, *Hall & Babcock* 4047a; Hupa, *Manning* 15; Comptche, *Jepson* 2233; Horse Mt., Lake Co., *Jepson*; Fairfax, Marin Co., *Edith A. Lee*; Santa Cruz Mts., *Jepson*; Mt. Pinos, *Hall* 6648; San Bernardino Valley, *W. G. Wright*; Alta Mdw., Sequoia Park, *Hopping* 93; Bear Valley, Nevada Co., *Jepson*; Mt. Lassen, *Hall & Babcock* 4364.

Refs.—Lilium pardalinum Kell. Proc. Cal. Acad. 2:12, pl. (1863), type from Alameda Co., *Kellogg*; Elwes, Monog. Lil. pl. 28 (1880); Jepson, Fl. W. Mid. Cal. 109 (1901). *L. californicum* Lindl., Elwes, l.c. pl. 29.

L. roezlii Regel, Gartenflora, 19:321, t. 667 (1870), type probably from California, not "Utah," *Roezl.*—Is one of many forms of L. pardalinum; perianth clear yellow with dark spots, and sometimes with clear red tips.—Occurs in the Siskiyou Mts., acc. Purdy. L. warei Purdy; Bailey, Stand. Cycl. Hort. 1878 (1916). Perianth clear rich yellow, unspotted, quite fragrant.—Said to have been found in Southern California, probably Lower California.

11. **L. parryi** Wats. Lemon Lily. Stem slender, glabrous, 2 to 5 feet high, 2 to 10-flowered; bulb like that of L. parvum, its scales numerous, thick, about 1 inch long; leaves usually scattered, sometimes the lower in a whorl, linear-oblanceolate, 4 to 6 inches long, about 1 inch wide, mostly acuminate; flowers clear lemon yellow, sparingly and minutely purple-black dotted, on stout short pedicels; perianth-segments 3 to 4 inches long, somewhat spreading above, or the tips recurved; stamens and style a little shorter; anthers oblong, brownish, 3 lines long; capsule narrowly oblong, acutish, nearly 2 inches long, 6 lines wide.

Moist situations, high mountains of Southern California. East to Arizona.

Locs.—Little Green Valley, San Bernardino Mts., *G. R. Hall* 18; Strawberry Valley, Mt. San Jacinto, *Hall* 2451; Palomar, acc. *Robt. Asher*; San Diego Co., *Gregory*.

Refs.—LILIUM PARRYI Wats. Proc. Davenport Acad. 2:188, tt. 5, 6 (1878), type loc. at head of stream running southerly into San Gorgonio Pass, *Parry*; Elwes, Monog. Lil. pl. 12, fig. 2 (1880).

21. **YUCCA** L. SPANISH BAYONET

Trees or shrubs with simple or branched stems. Leaves alternate, linear-lanceolate. Flowers large, in terminal panicles, the perianth-segments distinct, nearly equal, withering-persistent. Stamens 6. Fruit a capsule, either dry and dehiscent, or somewhat fleshy and indehiscent. Seeds numerous, in 2 rows in each cell, flat, horizontal, with thin black coat.—The flowers are incapable of self-pollination, each Yucca species being dependent upon a particular moth or species of Pronuba. The female Pronuba works by night, collecting the pollen from the anthers and rolling it into a little ball; she then flies to the flower of another plant, deposits her eggs in the ovary, and then in a manner which corresponds to actions full of purpose and deliberation climbs to the style and thrusts the pollen ball down the stigmatic tube. The larva destroys about a dozen seeds, but even if several larvae develop many perfect seeds are left.—Species about 28, North America. (An Indian name for the Manihot.)

Bibliog.—Engelmann, Geo., Notes on the Genus Yucca (Trans. St. Louis Acad. Sci. 3:17-54, 210–214,—1873). Baker, J. G., Synopsis of the Aloineae and Yuccoideae (Jour. Linn. Soc. Bot. 18:148-241,—1880). Riley, C. V., The Yucca Moth and Yucca Pollination (Rep. Mo. Bot. Gard. 3:99-158, pls. 34-43,—1892. Trelease, Wm., Detail Illustrations of Yucca (Rep. Mo. Bot. Gard. 3:159–166, pls. 1–12, 44–54,—1892; Further studies on Yuccas and their Pollination (l.c. 4:181-226, pls. 1-23,—1893); The Yucceae (l.c. 13:27-133, pls. 1-99,—1902).

Plants without evident trunk, the rosette of leaves on the ground; filaments glabrous; style slender with capitate stigma..........1. *Y. whipplei.*

Plants commonly with distinct trunk; filaments papillate; style short or none; stigmas 3, or 1 and 3-lobed.

  Trunk tall, at summit branching freely; leaf-margin denticulate..........2. *Y. brevifolia.*

  Trunk commonly short and simple or shortly branched; leaf-margin not serrate, fibrous-shredding.

    Style ½ to 1½ lines long..........3. *Y. mohavensis.*

    Style 6 to 10 lines long..........4. *Y. baccata.*

1. **Y. whipplei** Torr. QUIXOTE PLANT. Flowering stem 8 to 14 feet high, the leaves in a basal rosette; leaves narrow, 1 to 1¾ feet long; panicle 3 to 6 feet long; flowers creamy-white, 1¼ to 1½ inches long, the perianth-segments thinnish; filaments much thickened; capsule short-cylindric or subglobose, 1¼ to 2 inches long.

Chaparral belt of cismontane Southern California, north in the Coast Ranges to San Benito Co. and the Sierra Nevada as far north as Kings River. Lower California. May-June.

Biol. and Economic Note.—The mature individual produces offsets or new rosettes of leaves, in some cases only a few rosettes, yet again, especially towards the desert, a considerable number, thus becoming very caespitose. After the parent individual flowers and matures seed, it dies completely, the offsets representing individuals of a new generation. In this respect it differs entirely from our other species with woody and often branching trunks. In these species, *Y. brevifolia, Y. mohavensis* and *Y. baccata,* only the short branch which bears the panicle dies after fruit maturity.

The young flowering shoot is stripped and roasted by the native tribes who value it as a delicacy. The fibre of the leaves is manufactured into cordage.

Locs.—Pico Blanco, *Davy* 7335; Sans Mill, Santa Lucia Mts., *Jepson* 1684; se. San Benito Co., *Hall* 9943; Waltham Creek, *Jepson*; Tule River, *Jepson*; Cedar Creek, Sequoia Park, *Jepson* 589; Middle Fork Kings River below Tehipite, acc. *Hopping*; Santa Inez Mts., *Dunn*; San Bernardino, *Jepson* 5521; Thomas Valley, San Jacinto Mts., *Jepson* 1318.

Refs.—YUCCA WHIPPLEI Torr. Bot. Mex. Bound. 222 (1859), type loc. San Pasqual, *Schott*; Trel. Rep. Mo. Bot. Gard. 3:164, pls. 11, 12, 54 (1892). *Hesperoyucca whipplei* Baker, Jour. Linn. Soc. 18:230 (1880).

2. **Y. brevifolia** Engelm. Joshua Tree. Tree commonly 16 to 30 feet high with an open crown of arm-like branches, the columnar trunk 8 to 15 feet high and 1 to 3½ feet in diameter; bark dark brown, checked into small squarish plates; leaves 6 to 9 inches long, the margin denticulate, not shreddy; flowers greenish white, congested in a heavy panicle 8 to 14 inches long; perianth-segments very thick and fleshy, 1½ to 2 inches long; stamens ½ length of the pistil, the filaments subglobose-dilated at the recurved apex; stigmas 3, obscurely 2-lobed; capsule oblong-ovate, slightly 3-angled, 2 to 4 inches long and 1½ to 2 inches broad; seeds with ruminated endosperm.

Mesas, Mohave Desert, widely distributed and forming extensive groves, north to eastern Kern Co. and to Inyo Co. East through Nevada to Utah.

Locs.—Lancaster; Antelope Valley; Mohave; Kramer; Barstow, *Jepson* 4816; Coolgardie, *Jepson* 6631; Warrens Well; Cottonwood Mts.; New York Mts., *Jepson* 5443; Owens Lake; Kern Valley.

Refs.—Yucca brevifolia Engelm.; Wats. Bot. King, 5:496 (1871); *Jepson*, Silva Cal. 170, pl. 54 (1910). *Y. draconis* var. *arborescens* Torr. Pac. R. Rep. 4:147 (1857), type loc. e. Mohave Desert, *Bigelow*. *Y. arborescens* Trel. Rep. Missouri Bot. Gard. 3:163, pls. 5, 49 (1892); Sarg. Silva N. Am. 10:19, t. 502 (1896); Merriam, N. Am. Fauna, 7:353 (1893), contains an extensive list of stations. *Clistoyucca arborescens* Trel. Rep. Mo. Bot. Gard. 13:41 (1902). *C. brevifolia* MacBride, Contrib. Gray Herb. n.s. 53:6 (1918).

3. **Y. mohavensis** Sarg. Spanish Dagger. Trunk simple or shortly branched, 3 to 7 or 15 feet high, or sometimes very short or almost none; leaves concave, light yellow-green, entire on the margin, 1¼ to 3 feet long; flowers in a panicle 1 to 1½ feet long; filaments narrowly dilated below (especially those opposite the inner segments), somewhat clavate at apex, nearly as long as the pistil; style very short; stigma 3-lobed, each lobe notched at apex; capsule cylindric, fleshy, 2½ to 4 inches long and 1 to 1½ inches thick, usually constricted about the middle; endosperm not ruminated.

Mohave Desert south through the San Jacinto and Santa Rosa mountains to northern Lower California, extending west to the San Bernardino Valley and the coast near San Diego. East into Arizona and southern Nevada.

Locs.—Calico Mts.; Ord Mt., *Jepson* 5848; Warrens Well; Cottonwood Mts.; San Gorgonio Pass, *Jepson* 6068; Palm Cañon, Mt. San Jacinto, *Jepson* 1411a; San Timoteo Cañon, *Hall* 5751; Santa Rosa Mt., *Hall* 1905; San Felipe Valley, *Jepson*.

Refs.—Yucca mohavensis Sarg. Gard. & For. 9:104 (1896), type loc. Mohave Desert, *Sargent*, Silva N. Am. 10:15, t. 500 (1896); Jepson, Silva Cal. 171 (1910). *Y. baccata* Engelm. Trans. St. Louis Acad. 3:44 (1873), in part; Wats. Bot. Cal. 2:164 (1880), in part; Parish, Gard. & For. 4:136 (1891). *Y. macrocarpa* Cov. Contrib. U. S. Nat. Herb. 4:202 (1893).

4. **Y. baccata** Torr. Spanish Bayonet. Very similar to Y. mohavensis; leaf rosettes yellow-green, on the ground, rarely rising above it; leaves 1¼ to 2 feet long; flowering stem 2 to 3¼ feet high; flowers (2½ or) 3 to 4 inches long; base of filaments forming fleshy papillae; style much elongated; fruit conical.

Eastern Mohave Desert. East to Colorado and New Mexico.

Locs.—Providence Mts., *T. Brandegee*; New York Mts., *Parish* 10281.

Refs.—Yucca baccata Torr. Bot. Mex. Bound. 221 (1859), type loc. Parras, Coahuila, Mex., *Thurber*; Trel. Rep. Mo. Bot. Gard. 13:109, pls. 68, 69 (1902).

22. **NOLINA** Michx.

Perennials with linear rigid leaves crowded in a rosette at the ground. Flowering stem stout, naked. Flowers polygamo-dioecious, much congested in a compound panicle; pedicels jointed near the base. Perianth whitish, persistent, its segments 6, distinct, elliptic to lanceolate. Stamens 6; filaments very short. Ovary deeply 3-lobed; ovules 2 in each cell, basal; style very short; stigmas 3, short, recurved. Capsule broadly 3-winged, membranous, tardily dehiscent, loculicidal or bursting irregularly; seeds often solitary.—Species 24, southern United States and Mexico. (P. C. Nolin, French agricultural essayist, middle of the eighteenth century.)

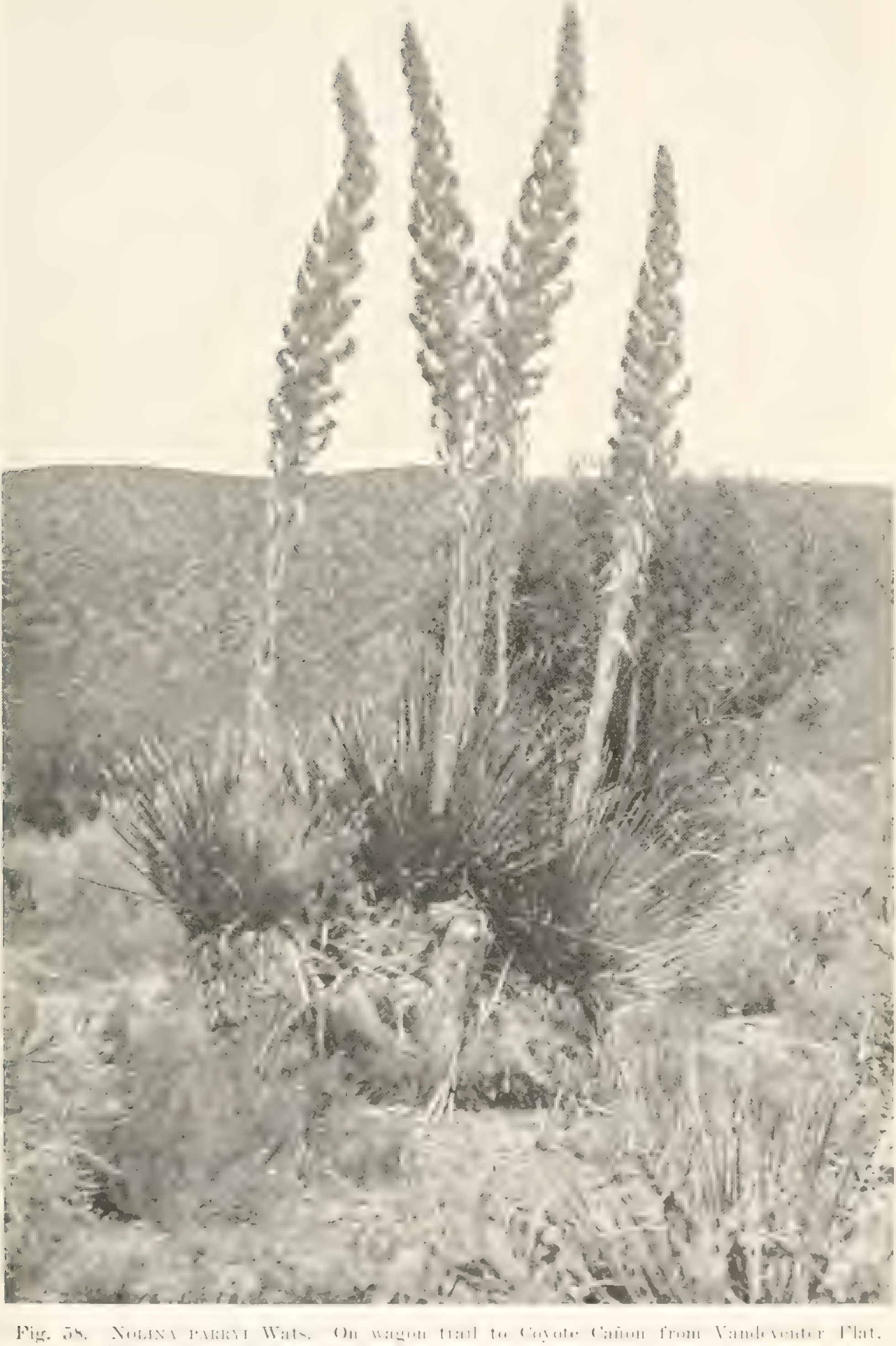

Fig. 58. NOLINA PARRYI Wats. On wagon trail to Coyote Cañon from Vandeventer Flat, Santa Rosa Mts. (Jepson, photo.)

Mature leaves serrulate; style present.......................................1. *N. parryi.*
Mature leaves not serrulate; style none.......................................2. *N. bigelovii.*

1. **N. parryi** Wats. (Fig. 58.) Stem 3 to 6 feet high; leaves rather thick, concave, keeled, serrulate, ¾ to 1¼ inches wide, 2 to 3⅓ feet long; bracts irregularly and remotely salient-laciniate; flowers 3 lines long; capsule orbicular in outline, notched at both ends, 6 to 7 lines broad.

Arid mountain slopes, 4000 to 6000 feet: eastern San Bernardino Mts., south through the San Jacinto Mts. to San Diego Co. Arizona; Lower California. May-June.

Locs.—Rattlesnake Cañon, e. San Bernardino Mts., *Parish* 3145; Tahquitz Valley, *Hall* 2432; Santa Rosa Mt., *Jepson* 1433; Corona, acc. Parish; Pala, *Orcutt*; San Felipe, *T. Brandegee.*

Ref.—NOLINA PARRYI Wats. Proc. Am. Acad. 14:247 (1879), type loc. desert east of San Bernardino, *Parry.*

2. **N. bigelovii** Wats. Leaves scarcely concave or keeled, the margin shredding away in brown fibres; margins of bracts deeply and rather closely fringed; perianth 1 to 1½ lines long.

Mountains, southern borders of the Colorado Desert; south into Lower California, east into Arizona.

Loc.—Mountain Sprs., San Diego Co., *Parish* 9044, only known station in California.

Refs.—NOLINA BIGELOVII Wats. Proc. Am. Acad. 14:247 (1879). *Dasylirion bigelovii* Torr. Pac. R. Rep. 4:151 (1857), type loc. Williams River, Ariz., *Bigelow.*

23. **ASPARAGUS** L.

Stem from a rootstock, very much branched and with filiform branchlets clustered in the axils of the scaly leaves. Flowers small, solitary or in umbels or racemes. Perianth-segments alike, distinct or slightly united, the stamens inserted on their bases. Ovary 3-celled, with 2 ovules in each cell; style short, stigmas 3, recurved. Fruit a globose berry.—Species 100, Old World. (Ancient Greek name.)

1. **A. officinalis** L. ASPARAGUS. Stems tall and branching, 3 to 5 feet high, when young stout, succulent and edible; clustered branchlets 4 to 8 lines long; flowers green, pendulous on jointed peduncles; perianth campanulate, 3 lines long, with included stamens; berry red, 4 lines in diameter.

Garden plant escaped to low lands about Alameda, San Bernardino and Los Angeles.

Ref.—ASPARAGUS OFFICINALIS L. Sp. Pl. 1:313 (1753), type European.

24. **STREPTOPUS** Michx. TWISTED-STALK

Stems branching from a creeping rootstock. Leaves alternate, ovate, sessile or clasping, taper-pointed, membranous. Flowers greenish-white, axillary, solitary or in pairs, drooping on slender filiform peduncles which are bent or contorted at the middle. Perianth campanulate, the lanceolate segments distinct, recurved-spreading, deciduous. Stamens 6; filaments short, flattened. Style 1; stigma slightly 3-lobed. Fruit a red ovoid or oval berry.—Five species, North America, Europe and Asia. (Greek streptos, twisted, and pous, foot or stalk.)

1. **S. amplexifolius** DC. LIVER-BERRY. Stem 1¼ to 3 feet high; leaves ovate, clasping, glaucous beneath, 2½ to 4¾ inches long; peduncles with a gland at the knee; flowers greenish-white, 5 to 6 lines long.

Margin of cold streamlets in the woods: Mendocino Co. to western Siskiyou Co., thence east and southeast to Modoc and Plumas cos., 1000 to 5500 feet. North to Alaska and east to the Atlantic. Europe, Asia.

Locs.—Dinsmore Ranch, Van Duzen River, *Tracy* 3956; Trinity Summit, *Jepson* 2058a; Marble Valley, w. Siskiyou Co., *Butler* 97; Sisson, *Jepson*; Forestdale, *M. S. Baker*; Mill Creek, Plumas Co., *R. M. Austin.*

Refs.—Streptopus amplexifolius DC. Fl. Fr. 3:174 (1805). *Uvularia amplexifolia* L. Sp. Pl. 1:304 (1753), type European.

25. DISPORUM Salisb.

Stem erect, branched above, leafy, arising from a short horizontal rootstock. Leaves ovate, sessile, thin, netted-veined. Flowers greenish or white, drooping on a terminal peduncle, solitary, or few in an umbel. Perianth campanulate, deciduous. Filaments filiform, attached within the anthers, above the base. Fruit a berry.—Species about 13, North America and Asia. (Greek dis, double, and spora, seed, some species with 2 ovules in each cell.)

Flowers greenish, ½ inch long or nearly; style glabrous, entire.
  Leaves 1½ to 3 inches long.
    Stamens equalling or exceeding the perianth; anthers not hispid; leaves mostly cordate at base .... 1. *D. hookeri.*
    Stamens generally slightly shorter than the perianth; anthers minutely hispid; upper leaves slightly cordate at base........................ 2. *D. trachyandrum.*
  Leaves 1 to 1½ inches long; stamens ½ the length of perianth, anthers nearly sessile........ 3. *D. parvifolium.*
Flowers whitish, ¾ to 1 inch long; leaves 2 to 4 inches long; style densely short hairy, slightly 3-cleft at apex; leaves sub-cordate or rounded at base........................ 4. *D. smithii.*

1. **D. hookeri** Britton. Fairy Bells. One to 2¼ feet high, roughish puberulent; leaves ovate, cordate at base, abruptly acute or attenuate, 1½ to 3 inches long, the uppermost somewhat oblique; perianth green, narrowly campanulate, 5 to 6 lines long, the tips of the segments spreading; stamens equaling or exceeding the perianth; berry obovoid to subglobose, obtuse, scarlet.

Shady woods back of the immediate coast, Coast Ranges from Santa Cruz Co. to Siskiyou Co.

Locs.—Berkeley, *Jepson* 8418; Franz Valley grade from Calistoga, *Jepson*; Hood's Peak Range, *Jepson*; Noyo River, *Charlotte Hoak*; Russian Creek, w. Siskiyou Co., *Butler* 93.

Refs.—Disporum hookeri Britton, Bull. Torr. Club 15:188 (1888); Jepson, Fl. W. Mid. Cal. 127 (1901). *Prosartes hookeri* Torr. Pac. R. Rep. 4:144 (1857), type loc. Oakland Hills, *Bigelow*. Var. *oblongifolia* Wats. Bot. Cal. 2:179 (1880).

2. **D. trachyandrum** Britt. Stem 1 to 2 feet high, purplish and nearly glabrous below, pubescent above; leaves ovate to oblong-ovate, abruptly acute to acuminate, sessile, upper ones very slightly cordate at base, 1 to 2½ inches long; flowers greenish, campanulate with spreading segment tips, nearly ½ inch long, on short drooping pedicels, solitary or in 2s or 3s; stamens slightly shorter than the perianth; anthers minutely hispid; ovary glabrous; style entire; berry obovate, scarlet.

In the Sierra Nevada, Tuolumne Co. to Siskiyou Co. Southern Oregon.

Locs.—Snow Creek, Fresno Co., *A. L. Grant* 1057; Hetch-Hetchy, *A. L. Grant* 987; Calaveras Big Trees, *A. L. Grant*; Siskiyou Co., *Butler* 787 (Humbug Mt.).

Refs.—Disporum trachyandrum Britton, Bull. Torr. Bot. Club 15:188 (1888). *Prosartes trachyandra* Torr. Pac. R. Rep. 4:144 (1857), type loc. Duffield's Ranch, near Confidence, Tuolumne Co., *Bigelow*.

3. **D. parvifolium** Britt. Rather stout, much branched, woolly-pubescent; leaves ovate to broadly lanceolate, the lower cordate and clasping, 1 to 1½ inches long, acuminate; flowers rather numerous, 4 lines long; segments slightly spreading, twice longer than the lanceolate acute nearly sessile anthers; ovary very small, slightly pubescent; style slightly exserted.

Siskiyou Mts. We have seen no authentic spms. Two spms. from Siskiyou Co. (Quartz Valley, *Butler* 690, and Kidder Creek, *Butler* 1222) have small rather dark green leaves and numerous flowers with a small ovary (glabrous or essentially so), but the stamens are more or less exserted with filaments twice the length of the anthers.

Refs.—DISPORUM PARVIFOLIUM Britton, Bull. Torr. Bot. Club 15:188 (1888). *Prosartes parvifolia* Wats. Bot. Cal. 2:179 (1880), type loc. Siskiyou Mts., *Rattan* (in fl., June, 1879).

4. **D. smithii** Piper. FAIRY LANTERN. One to 3 feet high, soft-pubescent or almost glabrous; leaves round-ovate to ovate-lanceolate, rounded or subcordate (and often a little oblique) at base, at apex abruptly acute or attenuate, 2 to $4\frac{3}{4}$ inches long; perianth whitish, broad and cup-shaped at base, $\frac{3}{4}$ to 1 inch long, the tips of the segments erect; stamens $\frac{1}{3}$ shorter than the perianth; berry yellow, oblong-obovate, attenuate above into a short beak.

Stream banks, Coast Range woods very near the coast: San Mateo Co. to Del Norte Co. North to British Columbia. Apr.

Locs.—Muir Woods, *A. L. Grant*; Inverness, *Jepson* 1716; Noyo River, *Charlotte Hoak*; Westport, *Jepson*; Del Norte Co., *Goddard*.

Refs.—DISPORUM SMITHII Piper, Contrib. U. S. Nat. Herb. 11:201 (1906). *Uvularia smithii* Hook. Fl. Bor. Am. 2:174, t. 189 (1839), type loc. Nootka Sound, *Menzies*. *Prosartes menziesii* Don, Trans. Linn. Soc. 1:48 (1839). *Disporum menziesii* Britton, Bull. Torr. Club, 15:188 (1888); Jepson, Fl. W. Mid. Cal. 127 (1901).

26. SMILACINA Desf.

Stem simple and leafy, from a horizontal rootstock, bearing a terminal raceme or panicle of small white flowers with minute bracts. Leaves sessile, many-nerved. Pedicels jointed at the summit. Perianth persistent, the segments distinct and spreading. Stamens inserted at the base of the segments; anthers versatile. Style 3-lobed at the summit, persistent; ovules 2 in each cell. Fruit a globose 1 to 3-seeded berry. Seeds sub-globose, with thin testa and horny endosperm.—Species about 20. North America and Asia. (Diminutive of smilax.)

Flowers in a simple raceme; stamens shorter than the perianth-segments; filaments not dilated.
  Leaves spirally arranged, often folded........................1. *S. stellata*.
  Leaves mostly 2-ranked, commonly flat........................2. *S. sessilifolia*.
Flowers in a panicle; stamens much longer than the perianth-segments; filaments dilated..........
3. *S. amplexicaulis*.

1. **S. stellata** Desf. STAR-FLOWER. Stem $\frac{3}{4}$ to 2 feet high; rootstock stout; herbage pale; leaves oblong-lanceolate to lanceolate, acuminate, often somewhat folded on the midrib, sessile and clasping, 3 to $5\frac{1}{2}$ inches long; raceme open, 6 to 20-flowered; pedicels 2 to 6 lines long; perianth-segments 2 to $3\frac{1}{2}$ lines long; stamens $\frac{2}{3}$ as long as the perianth-segments; style nearly equaling the ovary; berry at first with 6 dark-brown longitudinal stripes or bands on a greenish or whitish ground, eventually black.

Crests and east side of the Sierra Nevada; desert ranges of Mono and Inyo cos., south to Southern California, and east to the Atlantic.

Locs.—Fandango Valley, Warner Mts., *L. S. Smith* 931; Jess Valley, Modoc Co., *Jepson* 7941; Long Valley, Lassen Co., *Jepson* 7783; Kennedy Mdws., upper Stanislaus River, *Jepson* 6541; Sonora Peak, *A. L. Grant* 393; Silver Cañon, White Mts., *Jepson* 7203; Burdick, Owens Valley, *Almeda Nordyke*; San Gabriel Mts., *Peirson* 1682.

Refs.—SMILACINA STELLATA Desf. Ann. Mus. Par. 9:52 (1807). *Convallaria stellata* L. Sp. Pl. 1:316 (1753), type from Canada; Sims, Bot. Mag. t. 1043 (1807).

2. **S. sessilifolia** Nutt. SLIM SOLOMON. Similar to S. stellata and perhaps only a variety of it; rootstock slender; herbage bright green; upper part of stem commonly somewhat arcuately curving and the flat leaves disposed to be 2-ranked; leaves oblong-ovate to lanceolate; raceme commonly 3 to 9-flowered; stamens $\frac{1}{2}$ to $\frac{3}{4}$ as long as the perianth-segments; berry red, 1 to 4-seeded, 3 to 5 lines broad.

Common in shady woods and on moist brushy slopes: Coast Ranges, mostly near the coast; Sierra Nevada. North to Washington.

Locs.—Independence Lake, *Platt*; Yosemite, *Muir*; Natural Bridge, Tulare Co., *Culbertson* 4362; Big Creek, Santa Lucia Mts., *Marion Parsons*; San Juan, San Benito Co., *Brewer*

725; Loma Prieta, *Davy* 630; Los Gatos, *Heller* 7348; San Andreas Lake, San Mateo Co., *C. F. Baker* 1915; Berkeley Hills, *Jepson*; Mt. Tamalpais, *Jepson*; Inverness, *Jepson* 557a; Sonoma Geysers, *F. P. McLean*; Ft. Bragg, *W. C. Mathews* 87; Humboldt Hill, *Tracy* 1057; Trinity Summit, *Jepson* 2115.

Refs.—SMILACINA SESSILIFOLIA Nutt.; Baker, Jour. Linn. Soc. 14:566 (1875), based on material from British Columbia to California and New Mexico; Jepson, Fl. W. Mid. Cal. 126 (1901). *Unifolium sessilifolium* Greene, Bull. Torr. Club, 15:287 (1888). *Vagnera sessilifolia* Greene, Man. Bay Reg. 316 (1894). *Unifolium liliaceum* Greene, Pitt. 1:280 (1889), type loc. Siskiyou Co., *Greene* (Pitt. 2:31).

3. **S. amplexicaulis** Nutt. FAT SOLOMON. Stem 1 to 3 feet high, this and the under surface of the leaves with a minute fuzzy pubescence or rarely glabrous; rootstock stout, elongated; leaves oblong-ovate to lanceolate, 3 to 5½ inches long, acute at apex, sessile by a broad clasping base; panicle usually short-peduncled, oblong, 2 to 4 inches long; pedicels 1 line long or less; perianth-segments less than 1 line long; filaments lanceolate or broadly subulate, much longer and often broader than the segments; style ½ to nearly as long as the ovary; berry light red, finely sprinkled with dark red dots, 2 to 2½ lines in diameter, usually 1-seeded.

Shady woods, Sierra Nevada and Coast Ranges. North to British Columbia.

Locs.—North Fork Bidwell Creek, Modoc Co., *Jepson* 7901; Long Lake, Plumas Co., *Hall* 9320; Independence Lake, Nevada Co., *Platt*; Heather Lake, El Dorado Co., *Jepson* 8164; Armstrong's Sta., Amador Co., *Hansen* 1076; Calaveras Big Trees, *A. L. Grant*; Sonora Pass, *A. L. Grant* 154; Blue Cañon, Placer Co., *Harriet Walker* 1226; Huntington Lake, Fresno Co., *A. L. Grant* 1044; S. Fork Kaweah River, *Culbertson* 4252; Greenhorn Range, Kern Co., *Hall & Babcock* 5056; Deer Springs, San Jacinto Mts., *Hall* 2572; Notleys Ldg., Santa Lucia Mts., *Marion Parsons*; Saratoga, Santa Cruz Mts., *Jepson* 5630; Palo Alto, *Tidestrom*; Mt. Tamalpais, *Jepson*; Comptche, *Jepson* 2169; Redwood Creek, n. Humboldt Co., *Jepson* 1950; Russian Creek, Siskiyou Co., *Butler* 94; Mt. Shasta, *Setchell & Dobie*.

Var. **glabra** McBr. Leaves broadly oblong; herbage glabrous and slightly glaucous.—High altitudes, Humboldt Co. and Sierra Nevada.

Locs.—Trinity Summit, *Jepson* 2114; Matterhorn Cañon, Yosemite Park, *Jepson* 4502.

Refs.—SMILACINA AMPLEXICAULIS Nutt. Jour. Acad. Phila. 7:58 (1834), type loc. sources of the Columbia River, *Wyeth*; Jepson, Fl. W. Mid. Cal. 127 (1901). *S. racemosa* var. *amplexicaulis* Wats. Bot. King, 345 (1871); Henderson, Bull. Torr. Club, 27:357 (1900). *Unifolium amplexicaule* Greene, Bull. Torr. Club 15:287 (1888). *Vagnera amplexicaulis* Greene, Man. Bay Reg. 316 (1894). *V. pallescens* Greene, Proc. Acad. Phila. 47:551 (1895), type loc. Fresno Co. (middle elevations of the Sierra Nevada); pale glaucous-green but not glabrous; panicle 4 to 6 in. long (ex. char.). Var. GLABRA McBr. Contrib. Gray Herb. 56:18 (1918), type loc. South Fork Kaweah River, *Culbertson* 4252. *S. glabra* Tracy in herb.

27. **MAIANTHEMUM** Webb.

Stem low, from a horizontal rootstock, bearing 2 or 3 broad leaves and a terminal raceme of white flowers, the pedicels solitary or 2 or 3 in a cluster. Perianth-segments 4. Stamens 4, with filiform filaments. Ovary 2-celled; stigma 2-lobed. Fruit a globose red berry.—Species 2, northern hemisphere. (Greek maios, May, and anthemon, flower, in allusion to the flowering period.)

1. **M. bifolium** DC. var. **kamtschaticum** Jepson. Stem simple, erect, 4 to 14 inches high, often stout; leaves ovate- or triangular-cordate, 2 to 4½ inches long, the petiole of the lower one sometimes longer than the blade; basal leaf cordate, short-pointed, very large, very long-petioled, almost as tall as the flowering stem; raceme peduncled, ½ to 2 inches long; perianth-segments oblong or broadest toward apex, slightly unequal, 1 to 1½ lines long, becoming deflexed; berry 3 lines in diameter.

Woods of the North Coast Ranges near the coast from Marin Co. to Humboldt Co. Far north to Alaska. Asia.

Locs.—Sausalito, acc. Behr; Inverness, *Jepson* 8299; Mendocino City, *Bolander* 4777; Ft. Bragg, *W. C. Mathews*; Eureka, *Tracy* 2552.

Refs.—MAIANTHEMUM BIFOLIUM DC. var. KAMTSCHATICUM Jepson, Fl. W. Mid. Cal. ed. 2, 109 (1911). *Convallaria bifolia* var. *kamtschatica* Gmel. Linnaea 6:587 (1831), type loc.

Kamtchatea. *Maianthemum bifolium* DC. var. *dilatatum* Wood, Proc. Acad. Phila. 20:174 (1868). *Unifolium dilatatum* Howell, Fl. N.W. Am. 657 (1902). *U. bifolium* var. *kamtschaticum* Piper, Contrib. U. S. Nat. Herb. 11:200 (1906).

28. **CLINTONIA** Raf.

Stem from a creeping rootstock and bearing at or from beneath the ground a few broad leaves and a scape-like peduncle. Flowers few to many in a terminal umbel or with 1 to several small supplementary clusters scattered along the peduncle. Perianth resembling a very small lily flower, campanulate, of 6 distinct deciduous segments. Stamens 6, with filiform filaments, inserted on the base of the segments; anthers fixed just above the base, extrorse. Ovary 2 or 3-celled; ovules 2 or 3 in each cell; style slender, slightly 2 or 3-lobed, deciduous. Fruit a smooth ovoid (in ours blue) berry.—Six species, North America and Asia. (De Witt Clinton, 1769–1828, naturalist, several times governor of New York.)

Peduncles much exceeding the leaves; flowers in an umbel..... ....1. *C. andrewsiana.*
Peduncles shorter than the leaves; flowers solitary..2. *C. uniflora.*

1. **C. andrewsiana** Torr. Leaves commonly 5, sometimes 6, narrowly or broadly elliptic, rather abruptly short-pointed, 7 to 13 inches long, 2 to 4½ inches broad; peduncle 15 to 20 inches high, bearing a terminal umbel of many flowers and with 2 to 4 supplementary clusters borne laterally, the lateral clusters 1 to 9-flowered or rarely none; flowers 5 to 8 lines long, rose-red or pink; filaments slightly pubescent below the middle.

Shady woods near the coast: Monterey Co. north to Humboldt Co. The berries suggest small-sized old-fashioned bluing balls.

Locs.—Santa Lucia Mts., *Vortriede;* Carmel Highlands acc. *Anson Blake*; Redwood Peak, acc. *Docia Patchett;* Bolinas Ridge, *Chesnut & Drew;* Redwood Cañon, Marin Co., *Tidestrom;* Duncan Mills, *M. S. Baker*; Ft. Bragg, *W. C. Mathews* 31; Westport, Mendocino Co., *Jepson*; Pepperwood, *Jepson*; between Ryan's Slough and Freshwater Creek, *Tracy* 4473.

Refs.—Clintonia andrewsiana Torr. Pac. R. Rep. 4:150 (1857), type loc. Mt. Tamalpais, *Bigelow*; Jepson, Fl. W. Mid. Cal. 125 (1901).

2. **C. uniflora** Kunth. Bride's Bonnet. Leaves 2 or 3, oblong to narrowly elliptic, 4 to 6 inches long, including the short petiole-like base, and ¾ to 2 inches wide, acute; peduncle 1-flowered, shorter than the leaves, commonly with 1 or 2 small bracts; flowers white, 9 to 11 lines long; perianth-segments 6 to 8-nerved, much longer than the stamens.

Coniferous forests, Sierra Nevada, 3500 to 6000 feet, at scattered stations from Tulare Co. north to Lassen Co.; thence westerly to Siskiyou and Humboldt cos. North to British Columbia.

Locs.—Marble Fork, Kaweah River, *Hopping*; Merced Grove, *Jepson*; Calaveras Big Trees, *Brewer* 2095; Quincy, *R. M. Austin*; Wooley Creek, w. Siskiyou Co., *Butler* 98; Union Creek, Salmon Mts., *Hall* 8564; Trinity Summit, *P. E. Goddard*; Buck Mt., Humboldt Co., *Tracy* 2733.

Refs.—Clintonia uniflora Kunth, Enum. Pl. 5:159 (1850). *Smilacina borealis* var. *uniflora* Schult.; Roem. & Schult. Syst. 7:307 (1829), type from the North-west Coast, *Menzies*. *S. uniflora* Menzies; Hook. Fl. Bor. Am. 2:175, t. 99 (1839).

29. **SCOLIOPUS** Torr.

Stem very short, subterranean, bearing a pair of broad leaves and an umbel of greenish purple flowers, the peduncle almost obsolete, the sharply angular pedicels (which look like scapes) alone appearing above ground. Perianth-segments narrow. Stamens 3, opposite the sepals, short, with greenish extrorse anthers. Ovary triquetrous, 1-celled; style short, its 3 long branches abruptly spreading horizontally, often recurving at tip. Capsule with a membranous wall which bursts irregularly.—Species 2, California and Oregon. (Greek skolios, crooked, and pous, foot, in allusion to the tortuous pedicels.)

1. **S. bigelovii** Torr. SLINK-POD. Leaves usually 2 (rarely 3), elliptic to oblong, acute, commonly mottled with dark splotches, 4 to 9 inches long, sheathing at base; flowers with a fetid odor and having something the appearance of orchids; pedicels 4 to 9 inches long, 3-angled, slightly winged, erect in flower, in fruit tortuous recurving or procumbent, the maturing capsule more or less hidden by forest litter; sepals ovate-lanceolate, 7 to 9 lines long, with 10 or 12 black veins, somewhat carinate toward the base, the upper ⅗ abruptly spreading or recurved; petals linear-subulate, as long as the sepals, hardly 1 line wide, ascending at base and with their long points convergent, forming an arch above the pistil; stamens 2½ to 3 lines long.

Deep cold shades of the Redwood forest, Santa Cruz Co. to Humboldt Co. North to southwestern Oregon. Jan.-Mar. Called "Brownies" in Humboldt Co.

Locs.—Felton, *Sonne*; Kings Mt., *C. F. Baker* 322; Hillsboro, *Inez Smith*; Mill Valley, *Jepson*; Guerneville, *M. S. Baker*; Pepperwood, *Jepson*; Dinsmore Ranch, Van Duzen River, *Tracy* 4017.

Refs. SCOLIOPUS BIGELOVII Torr. Pac. R. Rep. 4:145, t. 22 (1857), type loc. Mt. Tamalpais, *Bigelow;* K. Brandegee, Zoe, 2:79 (1891); Jepson, Fl. W. Mid. Cal. 124 (1901).

30. TRILLIUM L. WAKE ROBIN

Stem simple, from a tuberous rootstock, naked below and bearing at the summit a whorl of 3 round-ovate netted-veined leaves and a single large flower. Perianth of 3 lanceolate herbaceous persistent sepals and 3 larger colored petals. Stamens 6, much shorter than the segments; anthers linear, on short filaments, adnate. Ovary 3 to 6-angled, 3-celled or 1-celled at summit. Styles 3, elongated, stigmatic down the inside. Fruit a fleshy reddish capsule. Seeds ovate.—About 17 species, North America and Asia. (Latin triplum, triple, on account of the 3-merous flowers.)

Bibliog. Gleason, H. A., Pedunculate Species of Trillium (Bull. Torr. Club, 33:387–396,—1906). Goodspeed and Brandt, Notes on the Californian Species of Trillium (Univ. Cal. Publ. Bot. 7:1–88, pls. 1–17,—1916–1917). Gates, R. R., Systematic Study of the N. Am. genus Trillium, its variability and its relation to Paris and Medeola (Ann. Mo. Bot. Gard. 4:43–92, pls. 6–8,—1917).

Flower sessile; leaves sessile..1. *T. sessile.*
Flower raised on a peduncle.
  Leaves sessile or nearly so; peduncle erect........................2. *T. ovatum.*
  Leaves petioled; peduncle usually declined........................3. *T. rivale.*

1. **T. sessile** L. var. **giganteum** H. & A. COMMON TRILLIUM. Stem stout, sometimes more than one from the same root, 1 to 1¾ feet high; leaves round-ovate, 2½ to 5 inches long, commonly broader than long; petals obovate to oblanceolate, 1½ to 3 inches long, deep red or lilac, or varying to dull white; capsule long-oval to subglobose, obscurely 6-angled above, circumscissile around the platform-like base.

Brushy or wooded hill-slopes or cañons: Coast Ranges from Monterey Co. north to Siskiyou Co., but not in inner Coast Range. North to Washington. The Californian plant is larger in all its parts than the Eastern plant (the type of T. sessile), but even this difference is not a constant one (*T. H. Goodspeed*). Feb.-Mar.

Locs.—Los Buellis hills, Santa Clara Co., *R. J. Smith*; Los Gatos, *Heller* 7254; Colma, *Michener & Bioletti*; Oakland Hills, *Jepson* 3107–3110; Howell Mt., *Jepson*; Lake Co., *Michener*; Yreka, *Greene*.

Var. **chloropetalum** Torr. Petals yellowish or greenish-yellow.—Monterey Co. to Siskiyou Co. and south in the northern Sierra Nevada to Placer Co. The form with pure white petals (Rock Lily) is found from Napa Valley to Humboldt Co.

Locs.—Mill Creek Cañon, Santa Lucia Mts., *Marion Parsons*; Crystal Springs Lake, San Mateo Co., *C. F. Baker* 431; Mt. Tamalpais, *Greene*; Olema, *Davy*; Clear Creek, Shasta Co., *Goldsmith*; Humbug, Siskiyou Co., *Butler* 669. Pure white flowers: St. Helena; Mendocino City; Buck Mt., Humboldt Co., *Tracy* 4181.

Var. **angustipetalum** Torr. Leaves 3 to 7 inches long; petals narrowly linear, typically 1 to 3 (rarely 5) lines wide.—Sierra Nevada; San Luis Obispo Co.

Locs.—Sierra Nevada: Pine Ridge, Fresno Co., *Hall & Chandler* 175; Hetch-Hetchy, *A. L. Grant* 986; Columbia, *A. L. Grant* 671; Strawberry, Tuolumne Co., *Jepson* 6501; Calaveras Big Trees, *A. L. Grant*. From Placer Co. north our spms. vary towards var. giganteum, having broader petals (6 to 7 lines wide): Applegate, Placer Co., *Abigail Smith;* N. Fork Butte Creek, Shasta Co., *Hall & Babcock* 4285. San Luis Obispo Co.: Arroyo Grande, *Brewer* 438; Santa Margarita, *N. K. Berg*.

Refs.—Trillium sessile L. var. giganteum H. & A. Bot. Beech. 402 (1841), type from Cal., *Douglas,* the usual purple-flowered form; Jepson, Fl. W. Mid. Cal. ed. 2, 107 (1910). *T. giganteum* Heller, Bull. S. Cal. Acad. 2:67 (1903). Var. chloropetalum Torr. Pac. R. Rep. 4:151 (1857), type loc. redwoods, Marin Co., *Bigelow*. *T. chloropetalum* Howell, Fl. N.W. Am. 661 (1902). *T. giganteum* var. *chloropetalum* Gates, Ann. Mo. Bot. Gard. 4:50 (1917). *T. sessile* var. *californicum* Wats. Proc. Am. Acad. 14:273 (1879). Var. angustipetalum Torr. Pac. R. Rep. 4:151 (1857), type loc. Calaveras Big Trees, *Bigelow*. *T. giganteum* var. *angustipetalum* Gates, l.c. 51.

2. **T. ovatum** Pursh. Coast Trillium. Stem 8 to 10 inches high; leaves ovate to round, sometimes disposed to be rhombic, abruptly acute, 2½ to 5½ inches long; petals oblong-lanceolate to ovate, 1 to 1½ inches long, white changing to deep rose-color; ovary incompletely partitioned above the middle; capsule broadly ovate, the angles projected into narrow wings.

Wooded cañons near the coast from Monterey Co. to Del Norte Co., thence east to Siskiyou and Shasta cos. North to British Columbia and Idaho. Mar.-Apr.

Locs.—Lucia, *K. Brandegee*; Felton, *Sonne*; San Leandro Creek, Oakland Hills, *H. H. Haworth*; Mill Valley, *A. L. Grant*; Olema, *Jepson*; Guerneville, *M. S. Baker*; Comptche, *H. A. Walker* 300; Sherwood, *Blasdale*; Hydesville, *Tracy* 4019; Crescent City, *Goddard*; Yreka, *Greene*; McCloud River, *Hall & Babcock* 4134.

Refs.—Trillium ovatum Pursh, Fl. 1:245 (1814), type loc. Cascades, Columbia River, *Lewis*; Jepson, Fl. W. Mid. Cal. 125 (1901).

3. **T. rivale** Wats. Stem slender, 4 to 10 inches high; leaves ovate, truncatish to cordate at base, 1½ to 3 inches long; flower on a peduncle 1 to 3¾ inches long; petals white, dotted with purple at the center, about 1 inch long; capsule scarcely angled.

Rocky banks, Del Norte and Siskiyou cos. North to southern Oregon.

Locs.—Gasquet, *Eastwood*. Josephine Co., Ore. (Waldo, *Howell*; Kirby, *M. S. Baker*).

Ref.—Trillium rivale Wats. Proc. Am. Acad. 20:378 (1885), type loc. Big Flat, S. Fork Smith River, Del Norte Co., *Shockley*.

31. SMILAX L. Greenbrier

Stems prickly or smooth, climbing by means of tendrils, arising from a tuberous rootstock. Leaves alternate, netted-veined, the petioles bearing near the base a pair of tendrils. Flowers small, greenish, dioecious, borne in axillary umbels. Perianth-segments distinct. Staminate flower with 6 stamens. Pistillate flower usually with 1 to 6 abortive stamens; ovary with 1 or 2 ovules in each cell; style short or none; stigmas 1 or 3. Fruit a berry.—Species 195, mostly in tropical regions. (Smilax, a Greek name.)

1. **S. californica** Gray. Stem woody, climbing over shrubs and trees or trailing over the ground, 3 to 6 (or 14) feet long; leaves ovate, sub-cordate, 2 to 4¾ inches long, on petioles ½ inch long; perianth 5 lines long, its segments 6; berries globose, black, 4 lines in diameter.

Butte Co. to Siskiyou Co., thence south to Trinity Co. North to southern Oregon.

Locs.—Big Chico, *R. M. Austin*; Dana, Shasta Co., *Hall & Babcock*; Sims, *Jepson*; Dunsmuir, *Jepson* 6173; Sisson, *Jepson;* Quartz Valley, *Butler* 1466; Wooley Creek, w. Siskiyou Co., *Butler* 146; Deadwood, *Blasdale*; Hy-am-pum, *Chesnut & Drew*.

Refs.—Smilax californica Gray, Bot. Cal. 2:186 (1880). *S. rotundifolia* var. *californica* A. DC. Monog. Phaner. 1:75 (1878), type loc. east side of the upper Sacramento Valley, *Hartweg* 342.

AMARYLLIDACEAE. Amaryllis Family

Perennial herbs with basal leaves. Flowers perfect, regular, the inflorescence borne on a scape-like stem. Perianth 6-parted, the 6 stamens inserted on its tube. Ovary inferior, 3-celled; style 1. Fruit a several to many-seeded capsule.—Species about 850 in 71 genera; all continents but chiefly tropical or subtropical. Amaryllis, Narcissus, and Hypoxis species are extensively cultivated in California gardens.

Bibliog. Engelmann, Geo., Notes on Agave (Trans. Acad. Sci. St. Louis, 3:291–322,—1875); Flowering of Agave shawii (l.c. 579–582, pl. 4,—1877). Baker, J. G., Handbook of the Amaryllideae (1888). Mulford, Isabel, Agaves of the U. S. (Rep. Mo. Bot. Gard. 7:47–100, pls. 26–63,—1896). Trelease, Wm., Agaves of Lower Cal. (Rep. Mo. Bot. Gard. 22:37–65, pls. 19–72,—1911). Berger, A., Die Agaven (pp. 1–288, figs. 1–79,—1915).

1. AGAVE L. Maguey

Perennial herbs with a basal rosette of leaves on a short or mostly subterranean trunk. Leaves in ours evergreen, fleshy, spine-tipped and margined by prickles. Flowering stem tall, arising from the center of the rosette. Flowers thick and fleshy. Stamens exserted.—Species about 250, South and North America, chiefly Mexico. *A. americana* L., Century Plant, is common in California gardens; in Mexico, just before flowering, a plant of this species yields for a long time one or two gallons a day of saccharine juice from which pulque, the national drink of Mexico, is made. *A. rigida* var. *sisalana* Engelm., of Mexico, yields Sisal Hemp.

Flowers about 4 in a cluster, the clusters racemosely or subspicately arranged along the terminal axis; stamens inserted at the middle of the perianth-tube..........1. *A. utahensis.*

Flowers many in terminal bunches on the branches of a panicle.
  Trunk subterranean or essentially so; stamens inserted at the mouth of the tube.
    Ovary fusiform, about twice as long as the perianth segments 2. *A. consociata.*
    Ovary flask-shaped, longer than the perianth segments . 3. *A. deserti.*
  Trunk rising above the ground; stamens inserted at the middle of the tube . ..4. *A. shawii.*

1. **A. utahensis** Engelm. Trunk subterranean; flowering stem 5 to 8 feet high; leaves thick, hard, 6 to 12 inches long, margined by white teeth and tipped by a spine 1 to 3 inches long; flowers yellow, 1 to 1⅓ inches long; perianth abruptly expanded above the tube, its lobes 5 to 6 lines long, 3 times as long as the very short free portion of the tube; capsule 1 to 1½ inches long, dark brown.

Death Valley region. East to southern Utah and northern Arizona.

Locs. Resting Sprs., acc. Coville; Ivanpah, acc. Mulford; Bonanza King Mine, Providence Mts., *Munz, Johnston & Harwood* 4302; Horn Mine, Turtle Mts., *C. L. Camp.* Sheep Mts., Nev., *Purpus* 6135.

Refs. Agave utahensis Engelm.; Wats. Bot. King. 497 (1871), type loc. St. George, Utah, *Palmer*; Cov. Contrib. U. S. Nat. Herb. 4:201 (1893); Mulford, Rep. Mo. Bot. Gard. 7:77, pl. 32 (1896).

2. **A. consociata** Trel. (Fig. 59.) Plants usually forming very dense and commonly circular colonies 3 to 12 feet broad; trunk none, the leaves densely clustered at the base; flowering stem slender, 6 to 12 feet high; leaves thick and fleshy, blue-green, 6 to 12 inches long, edged with straight or curved pale teeth and tipped with a slender black spine; inflorescence slender, rather sparse; flowers yellow, 1½ to 2¼ inches long; perianth lobes 7 to 8 lines long, the free portion of the tube only 1½ to 2 lines long; capsule 1¼ to 1¾ inches long, dark brown, abruptly short-pointed at apex.

San Jacinto Mts. south to eastern San Diego Co. Lower California.

Econ. Note. The central part of the rosette and the young flower stalk are roasted for food by the Coahuilla Indians who also use the leaf fibres, says Dr. D. P. Barrows, for the manufacture of cordage, ropes and bowstrings. The fibres are prepared by soaking and basting the leaves; an old woman then takes a handful, combs them straight between her

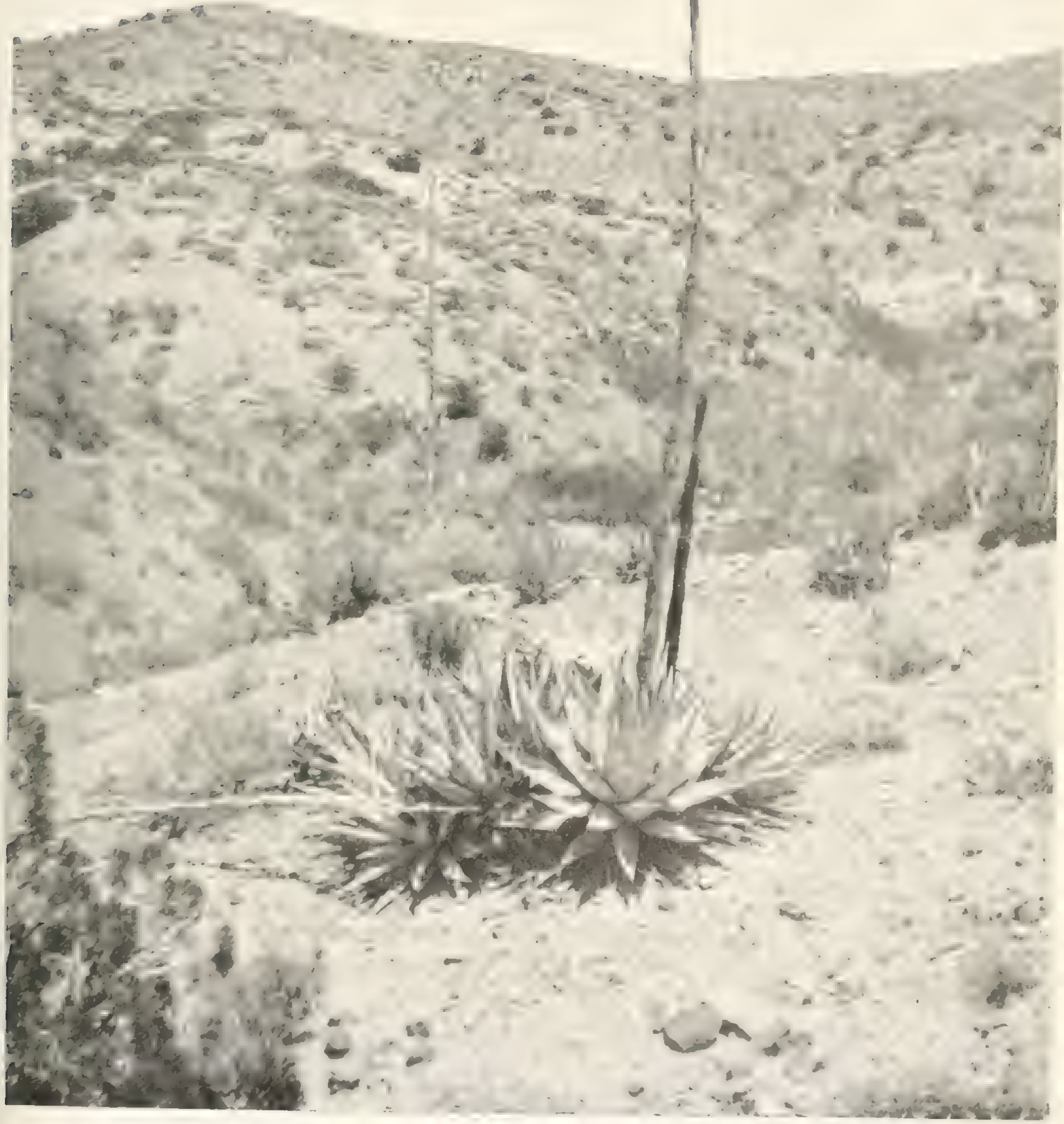

Fig. 59. AGAVE CONSOCIATA Trel. Palm Canon of Mt. San Jacinto. (Jepson, photo.)

fingers, wets the ends with saliva and "twists them into a beautiful cord on her bare thigh." Brooms are also made of the fibres. The flowers are boiled, dried for storing, and then boiled again when eaten. Cf. Barrows, Ethno-Bot. Coahuilla Ind. 47, 54, 58, 66.

Locs.—Palm Cañon, Mt. San Jacinto, *Jepson* 1356; Mason Valley, e. San Diego Co., *Jepson* 8710.

Refs.—AGAVE CONSOCIATA Trel. Rep. Mo. Bot. Gard. 22:53 (1911), type loc. San Felipe, *Parish* 413. *A. deserti* mostly of Cal. authors.

3. **A. deserti** Engelm. Similar to A. consociata, the plants forming rather open and more or less circular colonies 5 to 15 feet broad; scapes stout, 10 to 16 feet high; leaves whitish-green, 10 to 15 inches long; inflorescence large, dense; capsules 1 to 1⅓ inches long, light brown, rounded at apex.

San Felipe region, eastern San Diego Co.

Loc.—Mason Valley, *Jepson* 8711.

Refs.—AGAVE DESERTI Engelm. Trans. Acad. Sci. St. Louis, 3:310 (1875), based on spms. from the region of San Felipe, *Hitchcock*, *Palmer*; Trel. Rep. Mo. Bot. Gard. 22:52, pls. 41, 42 (1911).

4. **A. shawii** Engelm. Trunk 8 to 12 inches high, regularly leafy, the flowering stem 8 to 12 feet high; leaves green, glossy, ovate or lanceolate-ovate, acuminate, 8 to 20 inches long, margined with garnet-red hooked prickles; clusters of the panicle congested; flowers greenish-yellow, 3½ to 4½ inches long; perianth lobes 8 to 10 lines long, the free portion of the tube 7 to 9 lines long.

Southwestern San Diego Co. near the coast at the boundary, thence into Lower California.

Loc.—San Diego, *W. S. Wright* 113.

Refs.—AGAVE SHAWII Engelm. Trans. Acad. Sci. St. Louis, 3:315 (1875), type loc. first boundary monument near San Diego, *Parry*; Mulford, Rep. Mo. Bot. Gard. 7:85, pls. 44–47 (1896).

IRIDACEAE. IRIS FAMILY

Perennial herbs, ours low, glabrous, with stout stems and 2-ranked sword-like and sheathing leaves. Inflorescence terminal. Flowers perfect, with petal-like perianth of 6 divisions in 2 whorls. Stamens 3, on the base of the outer whorl, with extrorse anthers. Ovary inferior, 3-lobed, becoming a 3-celled capsule. Style 3-cleft or rarely entire; stigmas 3.—About 57 genera and 1000 species, mostly temperate and tropic zones.

Bibliog.—Baker, J. G., Handbook of the Irideae (1892). Hansen, J. G., Iris hartwegii (Gard. & For. 10:95–96,—1897). Bicknell, E. P., Studies in Sisyrinchium.—S. californicum and Related Species of the Neglected Genus Hydastylus (Bull. Torr. Club 27:373–387,—1900); The Species of California (l.c. 31:379–391,—1904). Dykes, W. R., The Genus Iris, pls. 1–47 (1913).

Stems terete; divisions of the perianth in two unlike whorls........1. IRIS.
Stems 2-edged or -winged; divisions of the perianth alike........2. SISYRINCHIUM.

1. **IRIS** L. FLAG

Stems terete, from creeping stout rootstocks. Flowers in the axils of spathaceous bracts. Perianth-tube prolonged beyond the ovary; outer segments or sepals obovate above the claw, spreading or recurved; inner segments or petals narrower, erect. Style divided into 3 petal-like branches, each branch with 2 lobes or appendages at summit; stigma a small projecting shelf (stigmatic only on the upper surface) situated on the lower surface of the branch just below the lobes or appendages. Stamens with linear anthers lying close beneath the branches of the style, i.e., opposite them. Capsule oblong, 3-angled. Seeds flattened or turgid, in 2 rows in each cell.—Species about 100, all continents but mostly north temperate zone. (Greek iris, the rainbow, the Greek species of the genus being celebrated for its brilliant colors.)

Rootstock ½ inch thick or more; dying leaves gray or yellow brown; seeds globular or pyriform.
    Plant sturdy; mature leaves as long or longer than stem, 4 to 6 lines wide..1. *I. longipetala.*
    Plant slender; leaves shorter than stem, 2 to 4 lines wide........2. *I. missouriensis.*

Rootstock ¼ inch thick or less; dying leaves red-brown; seeds roughly angled, or spherical in no. 3.
  Stem 1¼ to 2 feet high; leaves 3½ to 6½ lines broad, strongly ribbed; pedicels about 1 inch long; perianth-tube commonly ½ inch long..............................3. *I. douglasiana.*
  Stem commonly less than 1 foot high; leaves 3 lines broad or less, thickened, ribs less prominent.
    Perianth-tube 1½ to 3¾ inches long; pedicels ½ inch long..................4. *I. macrosiphon.*
    Perianth-tube ¼ inch long; pedicels ½ to 3 inches long...............................5. *I. hartwegii.*

1. **I. longipetala** Herbert. Coast Iris. Stem very stout, compressed, 1 to 2 feet high; leaves 4 to 6 lines broad, equaling or rather exceeding the flower-peduncles, turning gray or yellow-brown when dying; pedicels ½ to 3½ inches long; bracts scarious at apex, 2½ to 4 inches long, ¾ to 1⅜ inches broad (when spread out); sepals white, veined with violet, or violet above, 3 inches long, 1¼ to 1⅜ inches broad, narrowed to a short claw, the claw with a very prominent ventral ridge which disappears in the middle of the blade; petals light violet, 2¾ inches long, 6 to 7 lines wide; capsule narrowed at each end, 2 inches long; seeds pyriform.

Wet heavy soil, usually forming dense colonies: coastal region from San Francisco Bay to Monterey Co. Apr.

Locs.—Point Isabel, Contra Costa Co., *Davy*; Bald Peak, Berkeley Hills, *Hall*; South San Francisco, *C. F. Baker* 348; Monterey, *F. Guirado* 609.

Refs.—Iris longipetala Herbert; H. & A. Bot. Beech. 395 (1841), type from Cal., *Douglas;* Hook. Bot. Mag. t. 5298 (1862); Jepson, Fl. W. Mid. Cal. 129 (1901); Dykes, The Genus Iris, 89 (1913).

2. **I. missouriensis** Nutt. Western Blue Flag. Stem 10 to 24 inches high, exceeding the leaves (or a few leaves scarcely longer), nearly naked except at base; rootstock short, thick; leaves 2 to 4 lines wide, turning gray or yellow-brown when dying; bracts usually opposite, commonly membranous and straw-color, or sometimes thin, herbaceous; pedicels (1 or) 2 to 4 inches long; sepals whitish or pale blue, veined with purple and often with a central yellowish spot; petals pale blue to white, 2 to 2½ inches long, the tube about ¼ inch long; capsule 1½ to 3 inches long, grooved trough-wise on each face, cylindric in outline, or narrowed to both apex and base; seeds globular to pyriform.

Moist places, meadows or wet flats, high mountains: Sierra Nevada (mostly on the crest and east slope, rare on the west slope), southerly to the San Bernardino Mts., east to eastern Inyo Co., north to Modoc Co., thence southwesterly to the inner North Coast Range in Solano Co. in low valleys. Throughout the Great Basin and north to British Columbia and Dakota. July.

Locs.—Bear Valley, San Bernardino Mts., *Hall* 1024; Bitter Creek, Mt. Pinos, *Hall* 6512; Silver Cañon, White Mts., *Jepson* 7208; Snow Creek, Mariposa Co., *Congdon*; Hetch Hetchy, *Jepson* 3461; Walker Lake, Mono Co., *Jepson* 4446; Kennedy Lake, Tuolumne Co., *A. L. Grant*; Sonora Pass, *A. L. Grant* 307; Horse Lake, Lassen Co., *Jepson* 7811; Hat Creek, *Alma Ames*; Mt. Bidwell, *Manning* 56; Egg Lake, *M. S. Baker*; Goose Lake Valley, *R. M. Austin* 75; upper Fall River Valley, *Jepson* 5769; Quartz Valley, Siskiyou Co., *Butler* 1467; Black Butte, Mendocino Co., *W. W. Mackie*; Mendocino Range near Hopland, *Jepson* 7645; Rockville, w. Solano Co., *Jepson* 8247.

Refs.—Iris missouriensis Nutt. Jour. Acad. Phila. 7:58 (1834), type loc. sources of the Missouri River, *Wyeth*; Baker, Bot. Mag. t. 6579 (1881); Dykes, Genus Iris, 90 (1913).

3. **I. douglasiana** Herbert. Mountain Iris. Stem 1¼ to 2 feet high, much exceeded by the (3 to 9 lines wide) basal leaves, these reddish at base; bracts broader and less acuminate than in I. macrosiphon; flowers 2 or 3 in a pair of bracts, mostly cream-color, lavender or azure, often purple or lilac, the pedicels commonly 1 (½ to 1¼) inches long; perianth-tube usually ½ sometimes to 1½ inches long; petals 2 to 3 inches long; capsule narrowly oblong, sharply angled, 1¾ to 2 inches long; seeds spherical (or obovoid).

Common in the Redwood belt and on chaparral slopes in the Coast Ranges near the coast from Monterey Co. northwards; rare in the northern Sierra

Nevada. Oregon. May-June. The color of the flowers is exceedingly variable, but the species may be known from the next by its longer pedicels, shorter perianth-tube and stouter habit.

Locs.—Little Sur River, *Davy* 7310; Monterey, *Berg*; Anchorage, Santa Cruz Mts., *Carlotta Case*; Los Gatos, *Heller* 7305; Halfmoon Bay, *Geo. B. Furniss* (= var. altissima Purdy in litt.; 3 to 3¼ feet high); Millbrae, San Mateo Co., *Davy* 1021; Lake Merced, San Francisco, *E. Cameron*; Mt. Tamalpais, *Jepson* 7562; Inverness, *Jepson* 8303; Cazadero, *M. S. Baker*; Ukiah, *Bolander* 3909; Sherwood, *Jepson;* Cahto, Mendocino Co., *Jepson*; South Fork Eel River near Idolwild, *Jepson* 1909; Buck Mt., Humboldt Co., *Tracy* 4263; Auburn, Placer Co., *Sonne.*

Refs.—IRIS DOUGLASIANA Herbert; H. & A. Bot. Beech. 395 (1841), type from Cal., *Douglas*; Jepson, Fl. W. Mid. Cal. 129 (1901); Dykes, Genus Iris 36, pl. 8 (1913). *I. watsoniana* Purdy, Erythea, 5:128 (1897), type loc. Eureka, *Purdy*. *I. amabilis* Eastw. Bull. Torr. Club 30:484 (1903), type loc. Nevada City, *C. W. Kitts.* *I. tenuissima* Dykes, l.c. 44, type loc. Pitt River Ferry, Shasta Co., *Brown* 239.

4. **I. macrosiphon** Torr. GROUND IRIS. Stems low and slender, nearly naked or commonly clothed with bract-like leaves, much shorter than the basal leaves which are 5 to 12 (or rarely 27) inches long and 1 to 2 lines broad; bracts lanceolate, long acuminate, 2½ to 3½ inches long; flowers 1 or 2, on pedicels 6 to 7 lines long, with slender tube 1½ to 3 inches long; perianth violet-purple or straw-yellow, generally veined or mottled; sepals oblong-obovate or obovate, their lower or middle portion blotched or veined with white, the margin above often undulate; petals oblanceolate, of a uniform color, 1½ to 2¼ inches long; capsule short-oblong, ¾ to 1¼ inches long; seeds roughly angled.

Brushy slopes; 100 to 3000 feet, Coast Ranges from Santa Clara Co. north to Del Norte Co.; thence southeasterly to Butte Co. Also southern Oregon.

Locs.—Gilroy, *C. F. Baker* 1947; Mt. Hamilton, *Jepson* 4202; Ross Valley, *Jepson*; Olema, Marin Co., *Jepson;* Howell Mt., *Jepson* 516; Vaca Mts., *Jepson* 7192 (Weldon Cañon), 2456 (Wild Horse Cañon); Lakeport, *C. F. Baker* 3095; Hoods Peak Range, east of St. Helena, *Jepson*; grade betw. Blue Lakes and Ukiah, *Jepson*; Sherwood Valley, *Davy & Blasdale* 1061; Little Laribee Creek, Humboldt Co., *Tracy* 2684; Hupa, *Manning*; Klamath River, Humboldt Co., *Chandler* 1529; Adam Sta. to Patrick Creek, Del Norte Co., *Jepson* 2908; Marble Mt., *Chandler* 1570; Mt. Shasta, *F. W. Morse*; Little Chico Creek, *R. M. Austin* 13; Penn Valley, Nevada Co., *Jepson.*

Var. **purdyi** Jepson n. comb. Stem clothed with many bract-like leaves; perianth cream-color veined with purple.—Redwood region of Mendocino Co.

Refs.—IRIS MACROSIPHON Torr. Pac. R. Rep. 4:144 (1857), type loc. Corte Madera, *Bigelow*; Jepson, Fl. W. Mid. Cal. 129 (1901); Dykes, Genus Iris 43, pl. 12 (1913). *I. chrysophylla* Howell, Fl. N.W. Am. 1:633 (1897), type loc. southern Oregon, pine woods. Var. PURDYI Jepson. *I. purdyi* Eastw. Proc. Cal. Acad. ser. 3, 1:78, pl. 7, fig. 2 (1897), type loc. Mendocino Range near Ukiah, *Purdy*; Dykes, Genus Iris 42, pl. 11 (1913).

5. **I. hartwegii** Baker. SIERRA IRIS. Stems many, very leafy, 6 to 12 inches high; leaves ¼ inch wide or less; flowers commonly in pairs; pedicels ½ to 3¾ inches long, partly enfolded in the long lanceolate-acuminate bracts, which are borne more or less separate from each other; petals yellow with lavender veins or pale lavender with deeper-colored veins and a yellow median portion; tube 3 to 5 lines long; sepals and petals 1½ to 2½ inches long; capsule short-oblong, obtusely angled, ¾ to 1 inch long; seeds coarsely wrinkled, cubical.

Dry open forest, 2500 to 6000 feet: western slope of the Sierra Nevada from Plumas Co. to Kern Co.; southerly to cismontane Southern California. Very like *Iris tenax* Dougl. of Oregon and Washington save in color.

Locs.—McCloud Valley, *M. S. Baker;* Quincy, *Jepson* 4144; Stirling, Butte Co., *Heller* 10803; Jackson, *Hansen* 50; Strawberry, Tuolumne Co., *Jepson* 6522; Italian Bar, Tuolumne Co., *Jepson* 6356; El Portal, *Jepson* 3123a; Grouse Creek, Wawona Road, *Jepson* 8382; Dinkey Grove, Fresno Co., *A. L. Grant*; Colony Mill, Kaweah, *Hopping* 16: North Tule River, *Purpus* 5684; San Bernardino Mts., *Parish* 3084 (Grass Valley), 2466 (Strawberry Peak).

Refs.—IRIS HARTWEGII Baker, Gard. Chron. 2:323 (1876), type loc. Bear Creek, Nevada Co., *Hartweg* 373; Dykes, Genus Iris, 40, pl. 10 (1913). Var. *australis* Parish, Erythea 6:86 (1898), type loc. Cuyamaca, *Hall.*

2. **SISYRINCHIUM** L.

Stems slender, compressed and usually 2-edged or 2-winged, often geniculate, from fibrous roots, with grass-like or lanceolate leaves and fugacious relatively small flowers in umbels enclosed by 2 sheathing herbaceous bracts, with a scarious bractlet subtending each pedicel. Perianth 6-parted, the divisions alike, spreading. Stamens monadelphous, their anthers alternate with the 3 style branches or stigmas; stigmas thread-like.—Species 50, North America and the West Indies. (Name of Theophrastus for a bulbous plant allied to Iris.)

Stems 2-margined; perianth 4 to 7 lines long; spathe bracts generally shorter than or equal to the flowers.
    Flowers blue; filaments united to the top; anthers ⅕ to ⅓ as long as the filaments; style entire, stigmas short..........1. *S. bellum.*
    Flowers yellow; filaments united only at base; anthers equal to the filaments; style deeply cleft..........2. *S. californicum.*
Stems not margined but compressed; perianth 6 to 10 lines long, reddish-purple; outer spathe bract commonly exceeding the flowers..........3. *S. grandiflorum.*

1. **S. bellum** Wats. Blue-eyed Grass. Nigger-babies. Stems erect, simple or somewhat branching, 10 to 20 inches high; leaves shorter than the stem, 1 to 2½ lines wide; spathes of 2 nearly equal bracts 10 to 16 lines long, enclosing 3 to 7 flowers; perianth purplish (or sometimes very pale) blue, yellow at base, the segments oblong-obovate, conspicuously 4 to 6-nerved, 4 to 7 lines long, emarginate at apex, with a slender tooth in the notch, the inner narrower; anthers short, sagittate; style abruptly thickened or obclavate at apex (at least when young), divided at tip into 3 short stigmas; capsule globose, 2 to 3 lines long.

Moist grassy slopes, very common throughout California, rare in the deserts and arid areas east of the Sierra Nevada. Mar.-May.

Locs.—Sierra Nevada: Egg Lake, Modoc Co., *M. S. Baker*; Honey Lake, Lassen Co., *Davy* 3302; Colby, Butte Co., *R. M. Austin* 34; Tallac, *C. J. Fox Jr.*; Columbia, *Jepson* 6351; Herring Creek, Tuolumne Co., *A. L. Grant* 82; Yosemite Valley, *Hall* 9213; Kern River Cañon, *Jepson* 4979. Coast Ranges: Goosenest foothills, *Butler* 885; Quartz Valley, Siskiyou Co., *Butler* 1556; Comptche, Mendocino Co., *Harriet Walker* 290; Franz Valley grade, near Calistoga, *Jepson;* St. Helena, *Jepson;* Berkeley Hills, *Jepson* 9166; Mission San Jose, *Jepson* 2469; Los Gatos, *Heller* 7291; Monterey, *Elmer* 3522. Southern California: Santa Barbara, *Brewer* 366; Monrovia Cañon, *Peirson* 444; Pomona, *Braunton* 195; San Antonio Cañon, *Peirson* 11; San Bernardino, *Parish;* Santa Ana Cañon, *Hall* 7606; Tauquitz Valley, San Jacinto Mts., *Hall* 2470; San Diego, *Jepson* 6660.

Refs.—Sisyrinchium bellum Wats. Proc. Am. Acad. 12:277 (1877), based on California spms.; Bot. Cal. 2:140 (1880); Jepson, Fl. W. Mid. Cal. 129 (1901). *Bermudiana bella* Greene, Man. Bay Reg. 308 (1894). *Sisyrinchium leptocaulon* Bicknell, Bull. Torr. Club, 26:451 (1899), type loc. Lake Tahoe, *J. Ball*; l.c. 31:381 (1904). *S. idahoense* Bicknell, l.c. 26:445 (1899), as to California plants. *S. maritimum* Heller, Muhl. 1:48 (1904), type loc. Pacific Grove, *Heller* 6538, a low or stocky form in the sand hills by the sea. *S. oreophilum* Bicknell, l.c. 31:381 (1904), type loc. Yosemite Valley, *Bioletti. S. greenei* Bicknell, l.c. 31:383 (1904), type loc. n. side of Mt. Shasta, *H. E. Brown* 351. *S. eastwoodiae* Bicknell, l.c. 31:385 (1904), type loc. San Bernardino Valley, *S. B. & W. F. Parish* 663. *S. hesperium* Bicknell, l.c. 31:390 (1904), type loc. Dutard's Ranch, boundary Santa Barbara and San Luis Obispo cos., *Eastwood.*

Note on variation.—It is possible that the species proposed by Bicknell and others lack definiteness because insufficiently differentiated from extensive materials not used by them. The species, S. bellum, as here accepted, has a wide geographic range and an altitudinal range from 20 to 400 feet or in Southern California to 6000 feet; specimens from so wide a range show certain differences in size, habit, hue and number of flowers (differences which one readily associates with differences in moisture, soil or exposure) but they seem to lack technical characters on which to differentiate a series of species. Field notes of flowers and collections of fruiting material are, however, needed for more conclusive studies.

The plants in the desert region east of the Sierra Nevada do not seem substantially different from those of cismontane California. They grow in alkaline spots but the plants of the Coast are adapted to a wide variety of soils and sometimes grow in wet semi-alkaline valleys. The two climates, the desert and coast, are radically different but if it be said that the coast and desert forms must represent different species because the two climates are so different then the Aquilegia truncata, as it occurs in the Panamint Mts. (to mention only a single case) must be made a species distinct from the Aquilegia truncata plants of the coast, which no one so far has thought of doing. The facts are that the moisture conditions and the climatal conditions during the reproductive phase are sufficiently alike to enable one species to have a wide range. Hence we quote here: *S. halophilum* Greene, Pitt. 4:34 (1899), type loc. Humboldt Wells, Nev.; Bicknell, Bull. Torr. Club, 26:450 (1899); 31:380 (1904). *S. funereum* Bicknell, l.c. 387 (1904), type loc. Furnace Creek Cañon, Funeral Mts., *Coville & Funston* 225; spms. from Texas Spring, near Furnace Creek (*Jepson* 6872), have bracts with only 1 to 3 (or 4) flowers.

2. **S. californicum** Dry. Golden-eyed Grass. Stems unbranched, 4 to 12 (or 15) inches high, broadly winged, exceeding the leaves; bracts rather unequal, enclosing 3 to 7 flowers; perianth bright yellow; segments 4 to 6 lines long, 5 to 7-nerved, obtuse or acutish; anthers versatile, 1½ lines long, about equaling the filaments; style cleft to below the middle; capsule obovate-oblong, 4 lines long.

Wet places, infrequent: cismontane Southern California, Sierra Nevada and Coast Ranges. Northward to Oregon. Apr.

Locs.—Sugarloaf Mt., San Bernardino Co., *Hall* 7536; Middle Tule River, *Purpus* 5237; Junction Mdw., Kern Cañon, *Jepson* 5017; Wawona, *Congdon;* Crystal Sprs., San Mateo Co., *Eastwood*; Cliff House, San Francisco, *Drew*; Inverness, *Jepson* 8297; Eureka, *Tracy* 3247.

Refs.—Sisyrinchium californicum Dryander; Ait. f. Hort. Kew, ed. 2, 4:135 (1812); Jepson, Fl. W. Mid. Cal. 130 (1901). *Marica californica* Ker, Bot. Mag. t. 983 (1807), type loc. "Northwest Coast," *Menzies*. *S. elmeri* Greene, Pitt. 2:106 (1890), type loc. Lake Eleanor, Tuolumne Co., *Drew*. *Bermudiana californica* Greene, Man. Bay Reg. 308 (1894). *Hydastylus elmeri* Bicknell, Bull. Torr. Club, 27:380 (1900). *H. rivularis* Bicknell, l.c. 381 (1900), type loc. Bubb's Creek, Fresno Co., *Eastwood*.

3. **S. grandiflorum** Dougl. Scapes 6 to 12 inches high, bright green, exceeding the long-sheathing leaves; spathe 1 to 4-flowered; bracts very unequal, the outer usually much exceeding the broadly campanulate flowers; perianth-segments dark reddish-purple, rarely white, 6 to 10 lines long; filaments broad at base, 3 to 4 lines long, united ⅓ their length; anthers versatile, 2 lines long; style 6 to 7 lines long, cleft at apex, the branches thread-like, 1 line long or less; capsule depressed-globose, 6 to 8 lines long.

Moist places, hills and mountain slopes: Lassen and Modoc cos. westerly to Humboldt Co. North to British Columbia and east to Idaho and Nevada. Mar.-Apr.

Locs.—Milford, Lassen Co., *M. S. Baker;* Mt. Bidwell, *Manning* 82; Alturas, *L. S. Smith* 927; Lake City Pass, Modoc Co., *R. M. Austin*; Yreka, *Butler* 561, 646; Harris, Humboldt Co., *Ethel Tracy*. Mosier, e. Oregon, *Howell*.

Refs.—Sisyrinchium grandiflorum Dougl.; Lindl. Bot. Reg. t. 1364 (1830), type loc. great falls of the Columbia River, *Douglas*. *Olsynium grandiflorum* Rafin. New Fl. Am. 1:72 (1836). *Olsynium douglasii* Bicknell, Bull. Torr. Club 27:237 (1900).

ORCHIDACEAE. Orchid Family

Perennial herbs with corms, bulbs, tuberous roots or rootstocks and sheathing leaves often reduced to scales. Flowers perfect, irregular, bracted, either solitary or in spikes or racemes. Sepals 3, alike. Petals 3, 2 alike; the third petal called the "lip" commonly dissimilar in color, size and shape, often enlarged, sac-like or spurred, in our genera most frequently brought into an inferior position (i.e., on the lower side of the flower), by twisting of the ovary. Filaments united with the single style forming a column; perfect anther 1 (in Cypripedium 2), situated on the apex of the column and just above or behind the stigma, which is a viscid surface facing the lip. Pollen agglutinated into 2 to 8 pear-shaped masses. Ovary inferior, commonly long and twisted, 1-celled. Fruit a 3-valved capsule. Seeds innumerable, minute.—About 410 genera and 6500 species, all zones but abundant only in the tropics; the largest order of Monocotyledons and the third largest order of flowering plants.

Bibliog.—Nuttall, T., Remarks on the Species of Corallorhiza Indigenous to the U. S. (Jour. Acad. Phila. 3:135–139,—1823). Wiegand, K., Revision of the Genus Listera (Bull. Torr. Club 26:157–171, pls. 356, 357,—1899). Rydberg, P. A., Am. Species of Limnorchis and Piperia north of Mexico (Bull. Torr. Club 28:605–643, figs. 1:34,—1901). Ames, Oakes, American Species of Spiranthes (Orchidaceae, 1:113–154,—1905), The Genus Habenaria in North America (l.c. 4:1–288, pls. 60–79,—1910). Pfitzer, E., Cypripedium (Engler, Pflzr. 4^{50}:28–42 (1903).

Leaves foliaceous, i.e. the plants with green herbage.
Flowers solitary or several, showy; lip large and sac-like.
Leaves 2 to many, cauline; sepals and petals brown or greenish-yellow....1. CYPRIPEDIUM.
Leaf 1, basal; sepals and petals rose-purple....2. CYTHEREA.
Flowers many, spicate or racemose; lip various, but not saccate (except in no. 5).
Perianth with a spur....3. HABENARIA.
Perianth spurless.
Flowers in a spike.
Spike dense and twisted; leaves uniformly green....4. SPIRANTHES.
Spike more slender; leaves with white or light-colored markings....5. PERAMIUM.
Flowers in a raceme.
Leaves many; flowers ½ inch long or more; bracts conspicuous, foliaceous....6. EPIPACTIS.
Leaves 2; flowers less than ½ inch long; bracts small....7. LISTERA.
Leaves reduced and scale-like, the whole plant destitute of green herbage.
Plants white; perianth not gibbous or spurred; lip with saccate base and broad wing-like margins above....8. CEPHALANTHERA.
Plants reddish brown or purple, rarely yellow; perianth gibbous over the ovary or spurred; lip without saccate base....9. CORALLORRHIZA.

1. CYPRIPEDIUM L. LADY'S SLIPPER

Stems leafy, rough-pubescent, from tufted fibrous roots. Leaves 2 to many, large. Flowers few or solitary, large and showy, leafy bracted. Sepals spreading, in ours seeming as if only 2, the lateral completely or almost completely united into one under the lip, which is an inflated sac with the incurved margin auricled near the base. Column very short, incurved, terminating in a disk-like stigma. Fertile anthers 2, on short filaments, one on each side of the column below the stigma; sterile anther conspicuous, roundish or ovate, situated on the upper side and over-arching the stigma.—Species 28, North America and Asia. (Latin Cypris, Venus, and pes, a foot, the saccate lip a fit buskin for the goddess.)

Stem with several alternate leaves, 1 to 2 feet high.
Petals linear-lanceolate, 1½ to 2 inches long....1. *C. montanum.*
Petals oblong, 6 to 7 lines long....2. *C. californicum.*
Stem with 2 opposite leaves, 2 to 10 inches high; sepals and petals lanceolate, 6 to 12 lines long....3. *C. fasciculatum.*

1. **C. montanum** Dougl. Stem 1 to 2 feet high, rough-pubescent with short glandular hairs; leaves elliptic- to narrowly-ovate, the largest 5 or 6 inches long and 3 inches broad; flowers 1 to 3, shortly pediceled; sepals and wavy-twisted petals usually dark brown, linear-lanceolate, 1½ to 2½ inches long; lower sepals united almost to the apex, only the lanceolate-subulate tips free; lip 1 inch long, dull white, veined with purple; sterile anther ovate, 4 lines long, on a slender filament; capsule erect or nearly so, oblong, 10 lines long.

Dense woods: Coast Ranges from the Santa Cruz Mts. to Siskiyou Co., thence southeasterly in the Sierra Nevada to Mariposa Co. Far north to Washington and Idaho.

Locs.—Santa Cruz Mts., acc. *Anderson;* Ukiah, *Blasdale*; Sherwood Valley, *Blasdale* 1047; Hupa, *Manning* 16; Weaverville, *Yates* 311; Goosenest Mt., *Butler* 1586; Forestdale, Modoc Co., *M. S. Baker*; Butterfly Valley, Plumas Co., *R. M. Austin* 197; Grouse Creek, Yosemite, *Jepson* 4287.

Refs.—CYPRIPEDIUM MONTANUM Dougl.; Lindl. Gen. & Sp. Orch. 528 (1840), type loc. northwest America, *Douglas*; Jepson, Fl. W. Mid. Cal. 131 (1901); Anderson, Nat. Hist. Santa Cruz Co. 43 (1893).

2. **C. californicum** Gray. Stem stout, rough-pubescent, 1 to 2 feet high; leaves ovate-lanceolate (or ovate), acute or acuminate, 3 to 6 inches long, the upper lanceolate and gradually reduced to foliaceous bracts of the long loose raceme; flowers 1 to 6, short-pedicelled, greenish-yellow; sepals ovate, acute, 6 to 8 lines long, the two lower united to the apex, equaling the oblong-linear acutish petals; lip obovoid, white or light rose-color, veined with purple, 8 to 10 lines long, pubescent within at the base; sterile anther rounded and arching,

nearly sessile, 2 lines long, equaling the roughened stigma; capsule oblong, reflexed, 8 to 15 lines long.

Marin Co.; Del Norte Co., thence easterly to Lassen Co. Southern Oregon.

Locs.—Mt. Tamalpais, *Edith M. Wickes*; Siskiyou Mts., *Blasdale* 1077; Gasquets, Del Norte Co., *Davy*; Sisson, *Hall & Babcock* 4043; Mt. Dyer, Lassen Co., *R. M. Austin*.

Ref.—CYPRIPEDIUM CALIFORNICUM Gray, Proc. Am. Acad. 7:389 (1867), type loc. Red Mt., n.w. Mendocino Co., *Bolander*.

3. **C. fasciculatum** Kell. Stems slender, 2 to 10 inches high, pubescent, scariously sheathed at base; leaves 2, nearly opposite, ovate to nearly orbicular, 2 to 4 inches long, pale green, with 3 prominent ribs beneath; flowers solitary or 2 to several in a small terminal cluster; sepals and petals lanceolate, acuminate, 6 to 12 lines long, greenish-brown with brown veins; lateral sepals wholly united or very nearly so; lip depressed-ovate, greenish-yellow with brown or purplish margin, 4 to 6 lines long; sterile anther oblong, obtuse, equaling the stigma.

Dry open hillsides: Santa Cruz Co.; Plumas Co. to Del Norte Co. North to Washington.

Locs.—Glenwood, acc. *Eastwood*; Plumas Co., *R. M. Austin*; Butte Valley, *R. M. Austin* 198.

Refs.—CYPRIPEDIUM FASCICULATUM Kell.; Wats. Proc. Am. Acad. 17:380 (1882), type loc. White Salmon River, Wash., *Suksdorf*; Eastwood, Muhl. 3:97 (1907).

2. **CYTHEREA** Salisb.

Low herb with a corm and coral-like roots. Stem scape-like, sheathed by a few scale-like leaves, a single petioled leaf at base and a single drooping terminal flower. Flowers large, showy. Sepals and petals similar, equal, distinct; lip sac-like, terminating in 2 short spurs protruding from beneath a winged margin; upper side of sac inside with 3 densely ciliate ridges running from the opening towards the spurs, with 2 short spurs below the expanded apex. Column broadly winged, almost oval, concave, and petal-like; anther hemispherical, borne just below the summit, opening by a lid.—Species 1, North America, Europe. (Surname of Venus.)

1. **C. bulbosa** House. CALYPSO. Stem 4 to 5 inches high, the sheathing scales 1 to 2 inches long; leaf ovate, cordate or truncate at base, 1¼ to 2¼ inches long; petiole ½ to 1½ inches long; sepals and petals rose-purple, sometimes pale, linear-lanceolate, 9 lines long; lip as long or slightly longer, ovate-inflated, reddish brown and mottled.

Bogs or in leaf-mold in redwood or pine forests from Marin Co. to Siskiyou and Del Norte cos. North to Alaska and east across the continent.

Locs.—Bolinas Ridge acc. Eastwood; Cazadero, *Davy* 1652; Mendocino, *Mary G. Clark*; Sherwood Valley, *C. W. Bradford*; Carrville, Trinity Co., *Helen MacIlvain*; Hupa, *Chandler* 1280; Shackelford Creek, w. Siskiyou Co., *Butler* 1512; Crescent City, *Goddard* 317.

Refs.—CYTHEREA BULBOSA House, Bull. Torr. Club 32:382 (1905). *Cypripedium bulbosum* L. Sp. Pl. 951 (1753), type European. *Calypso borealis* Salisb.; Davy, Erythea 4:104 (1896); Jepson, Fl. W. Mid. Cal. 134 (1901). *Calypso bulbosa* Oakes, Cat. Ver. Pl. 28 (1842), f. *occidentalis* Holz. Contrib. U. S. Nat. Herb. 3:251 (1895). *C. occidentalis* Heller, Bull. Torr. Club 25:193 (1898).

3. **HABENARIA** Willd. REIN-ORCHIS

Stems erect, leafy at least at base, solitary from fleshy tuber-like roots. Flowers greenish, yellowish, or white, in a terminal spike or raceme. Sepals equal, the lateral mostly spreading, the petals a trifle smaller. Lip spreading or drooping, in ours entire, produced at base into a long slender spur. Column very short. Anther-sacs more or less divergent.—Species 300, all continents. (Latin habena, a thong or rein of a horse, on account of the shape of the spur in some species.)

Stem leafy at base; leaves withering at or before anthesis; lip with a more or less distinct median ridge; upper petals straight.
Spur shorter than the ovary; spike with flowers openly spaced..................1. *H. unalaschensis.*
Spur equaling or exceeding the ovary.
Slender, the spike lax, attenuate at tip; flowers whitish...................................2. *H. elegans.*
Stout, the spike dense.
Spike narrowly cylindric, rounded in outline at tip; flowers greenish....3. *H. michaeli.*
Spike cylindric-conical; flowers white...4. *H. maritima.*

Stem leafy; leaves remaining until fruit is set; lip flat or concave without median ridge; upper petals inarched and overlapping at tip.
Flowers white; stem thickened; lip rhombic-lanceolate....................................5. *H. leucostachys.*
Flowers greenish; stem very slender; lip narrowly linear.
Spur slender, equaling or longer than lip...6. *H. sparsiflora.*
Spur short, sac-like, shorter than lip...7. *H. saccata.*

1. **H. unalaschensis** Wats. Stem rigid, straight, erect, 1 to 2 (or rarely 3) feet high; leaves 3 or 4, basal, drying up by flowering time, 6 to 8 inches long, the lowest oblong, the upper oblong-lanceolate, longer; flowers greenish or yellowish green, openly spaced on the long tapering spike and exceeding the ovate-lanceolate bracts; perianth-segments 1 to 2 lines long; sepals translucent; upper sepal ovate-acute, somewhat deflexed between the greenish petals; lateral sepals and petals oblong-lanceolate; lip ovate, rounded at the apex, rather thick with a prominent ridge down the middle; spur thick, clavate, about equaling, or exceeding the lip, shorter than the ovary; capsule 6 to 8 lines long at maturity.

Dry soil, pine and fir forests: cismontane Southern California, Sierra Nevada, northerly to Siskiyou Co., thence southerly to Humboldt Co. Far north to Alaska.

Locs.—Cottonwood Creek, San Diego Co., *T. Brandegee*; Cuyamaca, *T. Brandegee*; Cajon Hills, *Dunn*; Del Mar, *T. Brandegee*; Paradise Valley, *D. Cleveland* 864; Hunsacker Flat, San Bernardino Mts., *Hall* 1356; Huntington Lake, Fresno Co., *A. L. Grant*; Wawona, *Jepson* 4307; Hetch-Hetchy, *A. L. Grant* 862; Strawberry, Tuolumne Co., *Jepson* 6498; Bear Valley, Nevada Co., *Sonne*; Mt. Shasta, *Jepson*; Yreka, *Greene*; Hupa, *Davy & Blasdale* 5637.

Refs.—HABENARIA UNALASCHENSIS Wats. Proc. Am. Acad. 12:277 (1877). *Spiranthes unalaschensis* Spreng. Syst. 3:708 (1826), type loc. Aleutian Isl. *Montolivaea unalaschensis* Rydb. Mem. N. Y. Bot. Gard. 1:107 (1900). *Piperia unalaschensis* Rydb. Bull. Torr. Club 28:270, 635 (1901). *Habenaria cooperi* Wats. l.c. type loc. San Diego, *Cooper*. *Piperia cooperi* Rydb. l.c. 636. *P. lancifolia* Rydb. l.c. 637, type loc. Sierra Santa Monica, *H. E. Hasse* 5675.

2. **H. elegans** Jepson. Slender, strict, 10 to 14 inches high; basal leaves oblanceolate to lanceolate, 2 to 3½ inches long, those of the stem reduced and acuminate or often almost none; spike slender, laxly flowered, attenuate at apex, 5 to 7 inches long; flowers whitish; upper sepal lanceolate; lip oblong-ovate, obtuse, spur as long as or a little longer than the ovary.

Southern California and Coast Range woods mostly near the coast from Monterey Co. north to Humboldt Co.; Sierra Nevada.

Locs.—Samoa, Humboldt Co., *Tracy* 880; Elk Mt., Lake Co., *Jepson* (nearest H. elegans but with the outline of spike and the lip of H. michaeli); Calistoga, *Jepson*; Miller Cañon, Monterey Co., *Hall* 10074; Palomar, *Hall* 5475.

Var. **elata** Jepson n. var. Taller (to 2⅓ feet high); spike stouter, elongated (10 to 13 inches long), slenderly attenuate.—(Elatior; spica robustior, elongata, unc. 10–13 longa, ad apicem perattenuata.)—Brushy hillslopes, Vaca Mts. to Alameda Co.

Locs.—Gates Cañon, Vaca Mts., *Jepson* (type); Berkeley Hills, *Jepson* 8192; Oakland Hills, *Bolander* 2431.

Refs.—HABENARIA ELEGANS Jepson. *Platanthera elegans* Lindl. Gen. &Sp. Orch. 285 (1835), type from Northwest America, *Douglas*. *Montolivaea elegans* Rydb. Mem. N. Y. Bot. Gard. 1:106 (1900), in part. *Piperia elegans* Rydb. Bull. Torr. Club 28:270, 638 (1901). *P. leptopetala* Rydb. Bull. Torr. Club 28:637 (1901), type loc. mts. east of San Diego, *Parry*. *P. multiflora* Rydb. l.c. 638, type loc. Gray's Harbor, Wash., is a form with narrow petals and sepals. *P. longispica* Rydb. l.c. 639, resting on *Gymnadenia longispica* Durand, Jour. Acad. Phila. ser. 2, 3:101 (1855), type loc. Nevada City, *Pratten*. *Habenaria longispica* Parish, Pl. World, 20:209 (1917). Var. ELATA Jepson (= *H. elegans* Boland. Cat. Pl. San Franc. 29,—1870).

3. **H. michaeli** Greene. Stout, 10 to 14 inches high; basal leaves oblanceolate, those of the stem prominent, scale-like, lanceolate-acuminate; spike dense, elongated-oblong, $2\frac{1}{2}$ to 6 inches long; flowers greenish; upper sepal ovate; lip triangular-ovate, subcordate at base; spur $\frac{1}{3}$ to $\frac{1}{2}$ longer than the ovary.

Open grassy Coast Range hills or under oaks, Humboldt Co. south to Ventura Co.

Locs.—Alton, Humboldt Co., *Tracy* 3763; Mill Valley, *Jepson*; Berkeley, *Mary V. Ferguson*; Livermore, *Jepson*; San Luis Obispo Co., *G. W. Michael*. The following are intergrades between H. michaeli and H. elegans, having the outline of spike, shape of lip and length of spur of the former, and the lax spike and usually spreading perianth of the latter: Sisson, *Jepson*; Shasta Sprs., *Jepson*; Ojai Valley, *Olive Thacher*.

Refs.—HABENARIA MICHAELI Greene, Bull. Cal. Acad. 1:281 (1885), type loc. San Luis Obispo, *G. W. Michael*. *Piperia michaeli* Rydb. Bull. Torr. Club 28:640 (1901). *H. elegans* Wats. Bot. Cal. 2:133 (1880). H. michaeli is reduced to H. elegans by Ames in his monograph of the genus (Orchid. 4:112); but although these two are not as yet clearly separated they represent in their extreme forms two differentiating phases, ecologically and otherwise, which merit further study and are of too much importance for simple reduction at present.

4. **H. maritima** Greene. (Fig. 60a, b.) Low and stout, 6 to 10 or 14 inches high; basal leaves oblong, acute, 3 to 6 inches long, 1 to $1\frac{3}{4}$ inches wide, the lowest narrowed to a broad petiole; upper cauline leaves reduced, appressed, lanceolate-subulate; spike very dense and thick, slightly conical, $1\frac{1}{2}$ to 4 inches long, 7 to 13 lines broad; flowers white, with a heavy fragrance; sepals broadly oblong, obtuse, with a green midvein, a little exceeding 2 lines; petals 2 lines long, broadest at the base, ligulate-attenuate above; lip narrowly ovate, with a prominent ridge toward the base; spur slender, longer than the ovary; column short and almost beakless.

Sea-cliffs or coast hills, San Francisco Co. north to Humboldt Co.

Locs.—Mission Hills, *Michener & Bioletti*; Pt. Reyes, *Davy* 6754; Fort Bragg, *W. C. Mathews* 148a; Samoa, Humboldt Co., *Tracy* 1253.

Refs.—HABENARIA MARITIMA Greene, Pitt. 2:298 (1892), type loc. Point Lobos, San Francisco; Jepson, Fl. W. Mid. Cal. 132 (1901). *Piperia maritima* Rydb. Bull. Torr. Club 28:641 (1901).

5. **H. leucostachys** Wats. SIERRA REIN-ORCHIS (Fig. 60c, d.) Stem thickened below, leafy, $\frac{3}{4}$ to $2\frac{1}{2}$ feet high; leaves linear or lanceolate, $\frac{1}{4}$ to $1\frac{1}{3}$ inches broad; flowers white, rather large, in a dense or open spike 4 to 8 inches long; bracts linear-subulate, shorter than the flower; sepals oblong or oblong-ovate, 3 or 4-nerved, thin, 2 to 3 lines long; petals lanceolate, oblique at base; lip slender-lanceolate from a roundish-dilated base, exceeding the sepals and petals; spur slender, 3 or 4 to 6 lines long, exceeding the lip; beak of the stigma prominent, ovate, more than half the length of the connective; capsule oblong, 6 to 9 lines long.

Common about springs and moist meadows: Sierra Nevada; North Coast Ranges; cismontane Southern California; White Mts. North to Alaska.

Locs.—Sierra Nevada: Plumas Co., *R. H. Platt*; Yuba Pass, Sierra Co., *Alma Ames* 15; Truckee, *Sonne*; Strawberry, Tuolumne Co., *Jepson* 6502; Kennedy Lake, Tuolumne Co., *A. L. Grant* 258; Yosemite Valley, *Hall* 9026; Bloody Cañon, Mono Co., *Chesnut & Drew*; Simpson Mdw., Middle Fork Kings River, *Henrietta Eliot*; Mineral King, *Hall & Babcock* 5386; Giant Forest, *Newlon*; Garfield Forest, Sequoia Park, *Jepson* 4660; Tehachapi, *Greene*. North Coast Ranges: Mt. Shasta, *Jepson*; Goosenest foothills, *Butler* 884; Marble Mt., *Chandler* 1726; Buck Mt., Humboldt Co., *Tracy* 3901; Fort Bragg, *Davy & Blasdale* 6146; Mt. Hull, Lake Co., *Hall* 9545; Point Reyes, *Davy* 6708. Southern California: San Bernardino Mts., *Blasdale*; Mt. San Jacinto, acc. *Hall*. Silver Cañon, White Mts., *Jepson* 7216. Not yet reported from the South Coast Ranges. Var. **virida** Jepson n. var. Lowest leaves elliptic to oblong; flowers greenish.—San Antonio Cañon, San Gabriel Mts., *F. W. Peirson* 12.

Refs.—HABENARIA LEUCOSTACHYS Wats. Bot. Cal. 2:134 (1880). *H. dilatata* var. *leucostachys* Ames, Orchid. 4:71 (1910). *Platanthera leucostachys* Lindl. Gen. & Sp. Orch. 288 (1835), type loc. Northwest Coast, *Douglas*. *Limnorchis leucostachys* Rydb. Mem. N. Y. Bot. Gard. 1:106 (1900); Bull. Torr. Club 28:625 (1901). *Habenaria pedicellata* Wats. Proc. Am. Acad. 12:276 (1877), type loc. Trinity Mountains (not "Shasta Mountains"), *Brewer* 1453

Refs.—Spiranthes romanzoffiana Cham. & Schlect. Linnaea 3:32 (1828), type loc. Unalaska, *Chamisso*; Jepson, Fl. W. Mid. Cal. 133 (1901). *Gyrostachys gemmipara* Ktze. Rev. Gen. Pl. 2:664 (1891). *G. romanzoffiana* MacM. Met. Minn. 171 (1892). *Orchiastrum romanzoffianum* Greene, Man. Bay Reg. 306 (1894). *Ibidium romanzoffianum* House, Muhl. 1:129 (1906).

2. **S. porrifolia** Lindl. (Fig. 60g.) Flowers creamy or yellowish white.

Marshy meadows or springy spots, cismontane Southern California, Coast Ranges, and Sierra Nevada. North to Washington.

Locs.—Bluff Lake, San Bernardino Mts., acc. *Parish* (Pl. World, 20:209); Santa Cruz Mts., acc. *Anderson* (Nat. Hist. Santa Cruz Co., 43); Howell Mt., *Tracy* 445; Ft. Bragg, *W. C. Mathews;* Dobbyn Creek, Humboldt Co., *Tracy* 4721; Mt. Shasta, acc. *Ames* (Orchid. 1:143); Sierra Valley, acc. *Ames* l.c.; Tallac, *Jepson* 8080; Amador Co., acc. *Ames* l.c.; Confidence, Tuolumne Co., *Jepson* 7702; Giant Forest, *Newlon.*

Refs.—Spiranthes porrifolia Lindl. Gen. & Sp. Orch. 467 (1840), type loc. northwest America. *Gyrostachys porrifolia* Ktze. Rev. Gen. Pl. 2:664 (1891). *Orchiastrum porrifolium* Greene, Man. Bay Reg. 306 (1894). *Ibidium porrifolium* Rydb. Bull. Torr. Club 32:610 (1905).

5. **PERAMIUM** Salisb. Rattle-snake Plantain

Scape erect, bearing a few sheathing scale-like leaves, a terminal spike, and at base a cluster of petioled white-reticulated leaves. Rootstock creeping, with fleshy roots. Flowers white, similar to Spiranthes. Lateral sepals free, the upper one united with the petals into an erect galea. Lip sac-shaped, sessile, entire and without callous thickenings at base. Anther without a lid.—Species 25, North America, Europe, Asia. (Greek pera, a leathern pouch, referring to the lip.)

1. **P. decipiens** Piper. Plants 11 to 15 inches high, glandular-pubescent, especially the scapes and inflorescence; leaves thickish, rosulate, oblong-ovate, acute at both ends, reticulated with white or light-colored veins or markings, $1\frac{1}{4}$ to $2\frac{1}{2}$ inches long, on petioles $\frac{1}{2}$ to $\frac{3}{4}$ inch long; flowers 3 to 4 lines long; spike 3 to 5 inches long.

Coniferous woods, Sierra Nevada from Mariposa Co. north to Modoc Co., thence westerly to Humboldt Co. and south along the coast to Marin Co. North to British Columbia, east to Quebec. Also in Arizona.

Locs.—Pohono Bridge, Yosemite Valley, *Hall*; Calaveras Big Trees, *A. L. Grant* 570; North Fork American River, *P. B. Kennedy* 407; Brush Creek, Butte Co., *Kate Conger*; Forestdale, Modoc Co., *M. S. Baker*; Shasta Springs, *Jepson*; Mt. Eddy, *C. F. Baker* 3929; Hupa, *Chandler* 1397a; Bald Mt., Humboldt Co., *Tracy* 4624; Humboldt Bay, *Tracy* 4595.

Refs.—Peramium decipiens Piper, Contrib. U. S. Nat. Herb. 11:208 (1906). *Spiranthes decipiens* Hook. Fl. Bor. Am. 2:203, t. 204 (1839), type loc. Lake Huron. *Goodyera menziesii* Lindl.; Wats. Bot. Cal. 2:136 (1880); Jepson, Fl. W. Mid. Cal. 133 (1901). *Peramium menziesii* Morong. Mem. Torr. Club 5:124 (1894). *Epipactis decipiens* Ames, Orch. 2:261 (1908).

6. **EPIPACTIS** Haller

Stem leafy from a creeping rootstock. Flowers in a raceme with foliaceous bracts. Sepals and petals nearly equal, spreading; lip strongly constricted at the middle, the lower portion deeply concave, the upper portion dilated. Anther 2-celled, sessile behind the broad truncate stigma, on a slender jointed base; the pollen-masses become attached above to the gland capping the small rounded beak of the stigma. Ovaries reflexed at maturity.—Species 10, north temperate zone. (Greek epipegnuo, because used to curdle milk.)

1. **E. gigantea** Dougl. Stream Orchis. Stout, 1 to 3 (or 4) feet high, nearly glabrous; leaves ovate below, lanceolate above, acute or acuminate, 3 to 7 inches long; raceme minutely pubescent; flowers 3 to 10, on pedicels 2 lines long; sepals greenish, 7 lines long (exceeding the petals), the upper concave and somewhat carinate; petals rose-color, purple-veined, particularly the lip; lower portion of lip with short erect lobes or wings and with many callous tubercles near the base, the upper portion ovate-lanceolate, crested or ridged toward the base.

Moist stream banks: mountains throughout California. North to Washington and east to Colorado and Texas. May.

Locs.—Southern California: Noble Mine, San Diego Co., *Chandler* 5477; Strawberry Valley, San Jacinto Mts., *Hall* 2370; Little Morongo Creek, acc. Parish; San Antonio Cañon, *Pearson* 13; Los Angeles, *G. S. Towne*; Mt. Pinos, *Hall* 6677. Coast Ranges: Lucia, Santa Lucia Mts., *Jepson* 1673; Mt. Diablo, *C. F. Saunders*; Sonoma Co., *Bioletti*; Grouse Creek, Humboldt Co., *Chesnut & Drew*; Siskiyou Co., *C. B. Bradley*. Sierra Nevada: South Fork Kaweah River, *Culbertson* 4286; Eagle Peak, Mariposa Co., *Chesnut & Drew;* Yosemite Valley, *Jepson*; Hetch-Hetchy, *Drew*; Douglas Flat, Tuolumne Co., *A. L. Grant* 902; Clover Creek, Plumas Co., *Jepson* 8025. Desert ranges: Panamint Mts., *Jepson* 7098; White Mts., *Jepson* 7214.

Refs.—EPIPACTIS GIGANTEA Dougl.; Hook. Fl. Bor. Am. 2:202, t. 202 (1839), type locs. Blue and Rocky mountains, *Douglas*; Jepson, Fl. W. Mid. Cal. 132 (1901). *Helleborine gigantea* Druce, Bull. Torr. Bot. Club 36:547 (1909). *Serapias gigantea* A. A. Eaton, Proc. Biol. Soc. Wash. 21:67 (1908).

7. **LISTERA** R. Br. TWAYBLADE

Stem low, bearing a pair of broad sessile opposite leaves at the middle, and arising from a cluster of fibrous creeping roots. Flowers small and greenish, in a loose raceme. Perianth spreading or reflexed; sepals and petals similar; lip free, longer than the sepals, flat and dilated, more or less deeply bifid. Column free, bearing the ovate anther naked (without lid) at the back of the summit. Pollen-masses 2, powdery, united to a very minute gland upon the rounded entire beak of the stigma. Capsule ovoid.—Species 12, frigid and north temperate zones. (Martin Lister, 1638–1711, a celebrated English naturalist.)

Leaves orbicular or ovate; raceme pubescent.
  Lip 4 to 5 lines long, distinctly obtuse lobed at apex, clawed at base....1. *L. convallarioides.*
  Lip 1½ to 2 lines long, apex rounded with a shallow notch bearing an inconspicuous tooth, base sessile with a short subulate tooth on each side..........2. *L. caurina.*
Leaves deltoid-cordate; raceme glabrous; lip sharply cleft to the middle into 2 attenuate lobes..........3. *L. cordata.*

1. **L. convallarioides** Torr. Stem slender, ¼ to 1 foot high, pubescent above the leaves; leaves orbicular to broadly ovate, often abruptly acute or obtuse at apex, 1 to 3 inches broad; flowers 6 to 12, greenish, on short pedicels; sepals and petals linear to linear-lanceolate, about 2 lines long; lip narrowly cuneate-obovate, 4 to 5 lines long, distinctly 2-lobed at the dilated apex, toothed on each side at base just above the short but slender claw, the basal papillae very minute or none; capsule 4 lines long.

Moist shaded places in the mountains, 3500 to 6000 feet: North Coast Ranges from Mendocino Co. to Siskiyou Co.; Sierra Nevada from Tuolumne Co. to Shasta Co.; San Jacinto Mts. North to Alaska, east to Newfoundland.

Locs.—Mt. Sanhedrin, *Hall* 9487; Smith Creek, Trinity Co., *Yates* 548; Coffee Creek, Salmon Mts., *Hall* 8533; Sisson, *Jepson*; Colby, Butte Co., *R. M. Austin* 839; Lassen Creek, *R. M. Austin* 215; Sierra Co., *Lemmon* 256; Truckee River, *Sonne*; Lake Tahoe, *Blasdale*; Carson Pass to Calaveras Big Trees, *Brewer* 2096; Brightman's Flat, Tuolumne Co., *A. L. Grant*; Snow Creek, Fresno Co., *A. L. Grant*; Giant Forest, *Newlon*; Snow Creek, Mt. San Jacinto, *Hall* 2534.

Refs.—LISTERA CONVALLARIOIDES Torr. Fl. N. U. S. 320 (1826). *Epipactis convallarioides* Swartz. Vet. Acad. Handl. Stock. 21:232 (1800), type loc. "E. terra Nova Amer. sept." *Ophrys convallarioides* Wight, Bull. Torr. Club 32:380 (1905).

2. **L. caurina** Piper. Stem very slender, 4 to 6 inches high, pubescent above the leaves; leaves ovate, acute or obtuse, sessile by a clasping base, 1 to 1½ inches long; bracts ovate, acute, ⅓ the length of the pedicels; flowers 5 to 15, greenish, very small, on pedicels 2 to 3 lines long; sepals and petals lanceolate to linear-lanceolate, 1 to 1½ lines long, spreading; lip 1½ to 2 lines long, cuneate, with an inconspicuous tooth in the shallow notch at the rounded apex and a short subulate tooth on each side at the base, a papilla at the base of each tooth; column short, not stout; capsule 3 lines long.

Damp woods, high mountains: Humboldt Co. Oregon to Idaho and Alaska.

Loc.—Hupa Mt., *Davy* 5648.

Refs.—LISTERA CAURINA Piper, Erythea 6:32 (1898), type loc. Henderson, Lane Co., Ore., *Piper*. *Ophrys caurina* Rydb. Bull. Torr. Club 32:610 (1905).

3. **L. cordata** R. Br. Stem slender, 2 to 8 inches high; leaves deltoid-cordate, $\frac{1}{2}$ to $1\frac{1}{4}$ inches broad, mucronate; raceme glabrous; flowers 6 to 24, purplish or yellowish; sepals ovate, about 1 line long; petals broadly oblong; lip narrow, twice the length of the petals, cleft to the middle into two attenuate lobes, and bearing an orbicular ridge at its base and a subulate basal tooth on each side; column very short; capsule 2 lines long.

Humboldt Co. North to Alaska and across the continent. Also in Europe and Asia.

Loc.—Buck Mt., near Van Duzen River, *Tracy* 2723.

Refs.—LISTERA CORDATA R. Br.; Ait. Hort. Kew. ed. 2, 5:201 (1813). *Ophrys cordata* L. Sp. Pl. 2:946 (1753), type European.

8. CEPHALANTHERA Rich.

Stem from a creeping rootstock, bearing medium-sized flowers in a bracted spike. Leaves in ours reduced to scarious sheaths. Sepals and petals nearly equal, connivent, the latter somewhat united and galeate, not gibbous at base. Lip free, concave, contracted and somewhat jointed in the middle. Column slender, elongated. Anther shortly stipitate, so as to be nearly or quite above the level of the top of the stigma. Pollen-masses not connected nor attached to a gland. Stigma wholly beakless.—Species 10, north temperate zone; northern Africa. (Greek cephale, head, and anthera, anther.)

1. **C. austinae** Heller. PHANTOM ORCHIS. Symbiotic saprophyte, the whole plant white, 10 to 20 inches high; rootstock upright with mycorhizal rootlets; leaves 3 to 6, 1 to 2 inches long; flowers many to numerous; sepals and petals similar, oblong-lanceolate, $\frac{1}{2}$ to $\frac{3}{4}$ inch long; lip shorter, its middle lobe hinged, 3 to 5-nerved within, and with upturned sides, the lateral lobes (with the column) forming a saccate base; column 2 lines long, about twice longer than the anther.

Dense mountain forests, Coast Ranges and Sierra Nevada northward. Oregon. Very rare.

Locs.—Santa Lucia Mts., *Jepson*; Mt. Sanhedrin, *Hall* 9489; Trinity Summit, *Jepson* 2027; Salmon Summit, w. Siskiyou Co., *Jepson* 2090; Mt. Shasta, *Hall & Babcock* 4079; Strawberry, Tuolumne Co., *Jepson* 6467; Yankee Hill, Columbia, *A. L. Grant* 1224; Little Yosemite Valley, *Hall* 9045; Snow Creek, Fresno Co., *A. L. Grant*.

Refs.—CEPHALANTHERA AUSTINAE Heller, Cat. N. Am. Pl. ed. 2, 4 (1900). *Chlorea austinae* Gray, Proc. Am. Acad. 12:83 (1876), type loc., Quincy, Plumas Co., *R. M. Austin*. *Serapias austinae* A. A. Eaton, Proc. Biol. Soc. Wash. 21:66 (1908). *Cephalanthera oregana* Reich. f., Linnaea 41:53 (1877), type loc. Willamette Valley, Ore., *Nuttall*; MacDougal, Bull. Torr. Club 23:513–518, pl. 367 (1899).

9. CORALLORRHIZA R. Br. CORAL-ROOT

Brownish or yellowish saprophytes or root-parasites, destitute of green herbage, and with branching toothed coral-like roots. Stems scape-like, the leaves reduced to scales, and bearing the flowers in a terminal raceme. Perianth-segments oblong or lanceolate, nearly alike, ours 3-nerved, gibbous at base over the ovary, or the lateral sepals united at base with the foot of the column, forming a short spur which is adnate to the summit of the ovary. Lip 1 to 3-ridged. Column 2-edged, slightly incurved. Anther terminal, opening by a lid. Pollen masses 4, soft-waxy. Capsules reflexed.—Species 12, north temperate zone. (Greek korallion, coral, and rhiza, root.)

Perianth 3 to 4 lines long, the lateral sepals with a spur at base.
  Spur wholly attached to the ovary; lip broad, 3-lobed, spotted........................1. *C. maculata*.
  Spur free for its apical half; lip oblong, entire, or toothed at base, dark red........................ 2. *C. mertensiana*.
Perianth 6 to 8 lines long, gibbous at base; spur none; lip entire, purple-veined....3. *C. striata*.

1. **C. maculata** Raf. Stems 8 to 13 inches high; raceme 2 to 7 inches long; sepals and petals brownish-purple, 3-nerved, 3 to 4 lines long; lateral sepals united at base with the foot of the column forming a short (1 line long) spur which is adnate to the ovary; lip white, conspicuously spotted with purple, broadly ovate and somewhat convex, 3 lobed by a deep cleft on each side; middle lobe rounded, the edge turned up a little on the sides and denticulate at apex; capsule ¾ inch long.

Mountain woods, mostly 3000 to 6000 feet: cismontane Southern California, north through the Coast Ranges and Sierra Nevada to Siskiyou Co. North to British Columbia; east to the Atlantic.

Locs.—Southern California: Palomar, San Diego Co., *McClatchie*; Tauquitz Valley, *Hall* 2345; Little Green Valley, San Bernardino Mts., *G. R. Hall* 15. Coast Ranges: Burlingame, *M. S. Baker*; Mt. St. Helena, *Jepson*; Castle Peak, ne. Mendocino Co., *Jepson*; Buck Mt., Humboldt Co., *Tracy* 4191; Buckeye Mt., Trinity Co., *Yates* 460; Green Pt. Ranch, Hupa Road, *Jepson* 1947; Sisson, *Jepson*. Sierra Nevada: Round Mdw., Giant Forest, *Jepson* 662; Huntington Lake, *A. L. Grant* 1115a; Wawona, *Jepson* 4306; Cedar Creek, upper Stanislaus River, *Jepson* 6527; Calaveras Big Trees, *A. L. Grant* 575; Bear Valley, Nevada Co., *Jepson*; Sierraville, *Alma Ames* 13; Big Mts., Modoc Co., *M. S. Baker*.

Refs.—CORALLORRHIZA MACULATA Raf. Am. M. Mag. 2:119 (1817); Greene, Leafl. 1:237 (1906). *Cladorhiza maculata* Raf. l.c. 1:429 (1817), type loc. Philadelphia. *Corallorrhiza multiflora* Nutt. Jour. Acad. Phila. 3:138, pl. 7 (1823), type from eastern U. S.; Jepson, Fl. W. Mid. Cal. 134 (1901); Gruenberg, Bull. Torr. Club 36:167 (1909).

2. **C. mertensiana** Bong. Stems 6 to 20 inches high; raceme more open than in C. maculata, its axis lurid-purple; flowers reddish tinged or veined with purple; sepals and petals linear-lanceolate, 3 or 4 lines long; upper sepal erect, covering closely the two petals; lower sepals deflexed-spreading; spur 1 line long, the lower half free from the ovary; lip dark red, oblong, obtuse, entire or with a tooth on one or both sides near the base, clawed below, thin and concave, the ridges only slightly prominent; capsule 5 to 8 lines long, attenuate into the short slender pedicel.

Woods, Humboldt and Siskiyou cos. North to Alaska.

Locs.—Bald Mt., Humboldt Co., *Davy & Blasdale* 5621; Redwood Creek, Humboldt Co., *Jepson* 1984; Trinity Summit, *Manning* 15½; Mt. Eddy, Siskiyou Co., *E. B. Copeland* 3926.

Refs.—CORALLORRHIZA MERTENSIANA Bong. Mem. Acad. St. Petersb. ser. 6, 2:165 (1832), type loc. Sitka, *Mertens*.

3. **C. striata** Lindl. (Fig. 60h.) Stems many in a cluster, 8 to 20 inches high, with 3 or 4 sheathing leaves; raceme 2 to 8 inches long; sepals and petals somewhat flesh colored, striately 3-nerved with purple or reddish brown lines, about 6 lines long, approximated on upper side of flower and curved over column in such a way as to form a sort of hood; lateral sepals oblique; lip quite entire, its edge a little upturned; spur none but the base of the perianth prominently gibbous over the ovary; capsule 6 to 9 lines long.

Woods along the coast from Santa Cruz Co. to Humboldt Co.; Sierra Nevada and northerly to Modoc and Siskiyou cos. North to British Columbia and east to Ontario.

Locs.—Burlingame, *Ira Smith*; Camp Taylor, Marin Co., *Sonne*; Mt. Tamalpais, *Davy*; Cahto, Mendocino Co., *Davy* 6612; Buck Mt., Humboldt Co., *Tracy* 4131; Trinity Summit trail, *Davy* 5818; Humbug Mt., Siskiyou Co., *Butler* 1292; Modoc Co., *M. S. Baker*; Prattville, Plumas Co., *R. M. Austin*; Blue Cañon, Placer Co., *H. A. Walker* 1221; Calaveras Big Trees, *A. L. Grant*; Strawberry, Tuolumne Co., *Jepson* 6499; Eight-mile, Wawona, *Jepson* 4289; Pine Ridge, Fresno Co., *Hall & Chandler* 108. Not yet reported from Tulare Co.

Refs.—CORALLORRHIZA STRIATA Lindl. Gen. & Sp. Orch. 534 (1840), type from northwest America, *Douglas*; Torr. Pac. R. Rep. 4, pl. 25 (1857). *C. bigelovii* Wats. Proc. Am. Acad. 12:275 (1877), based on material from the "Sierra Nevada and mountains of n. California."; Jepson, Fl. W. Mid. Cal. 134 (1901).

JEPSON, FLORA OF CALIFORNIA, vol. 1, pt. 6, pp. 249–336, Oct. 24, 1921.

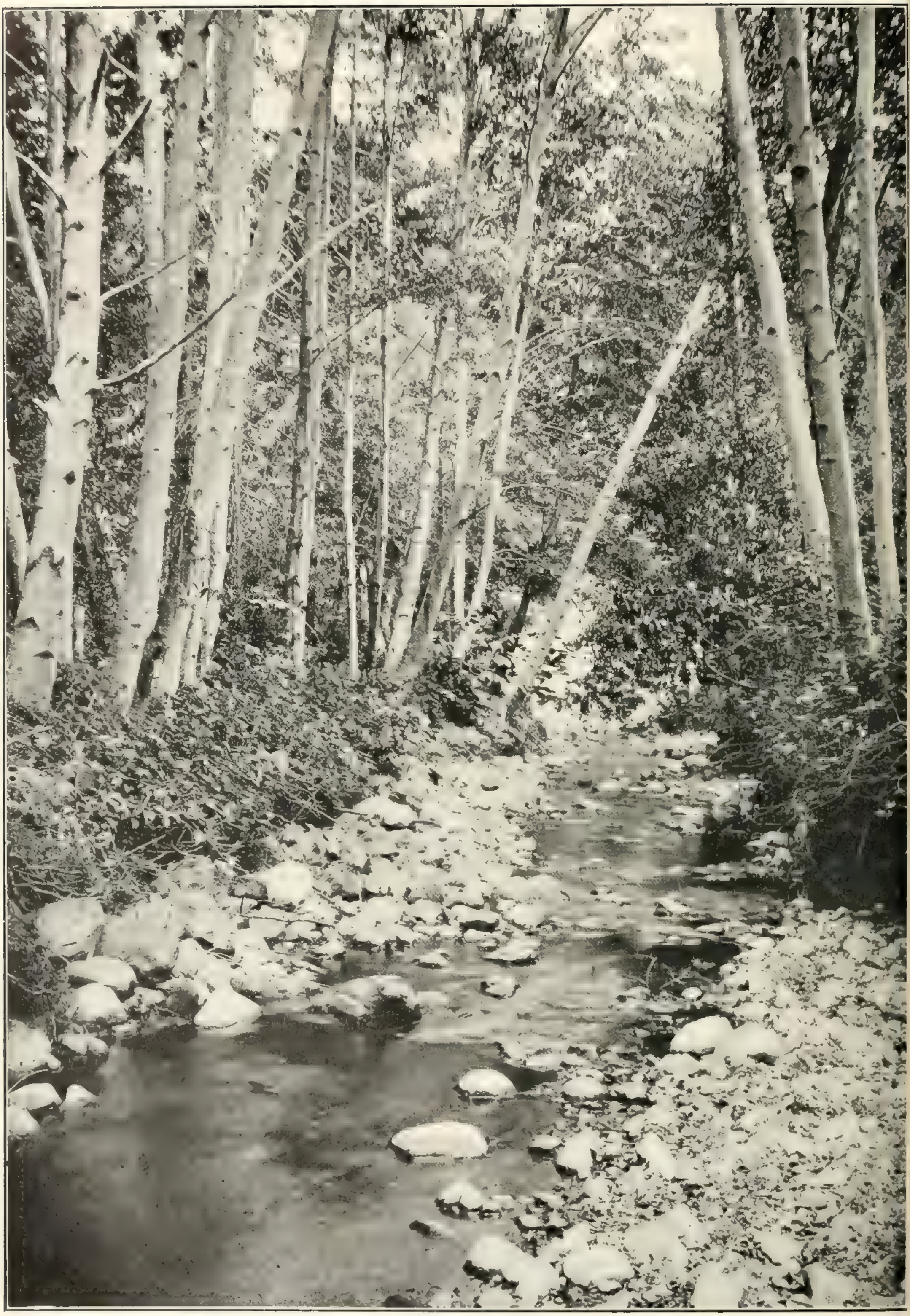

Fig. 61. Alnus rhombifolia Nutt. Typical growth along stream. Tributary of Sonoma Creek near Glen Ellen.

DICOTYLEDONS.

Leaves netted-veined. Stem increasing in diameter by an annual layer of wood inside the bark. Flowers with the parts in 4s or 5s, the perianth commonly differentiated into calyx and corolla, sometimes absent. Embryo with 2 cotyledons.

CHORIPETALAE.

Calyx usually present, sometimes petal-like. Corolla present or absent, when present consisting of distinct or nearly distinct petals.

SALICACEAE. Willow Family.

Trees or shrubs of rapid growth, light wood and bitter bark. Leaves simple and alternate, with stipules. Flowers dioecious, borne in catkins, these falling off as a whole, the staminate after shedding the pollen, the pistillate after ripening of the fruit and dispersion of the seeds. Bracts of the catkin scale-like. Calyx and corolla none. Stamens 1 to many. Ovary 1-celled; stigmas 2. Fruit a 2 to 4-valved capsule, enclosing many seeds furnished with a tuft of hairs at base.—Two genera.

Bibliog.—Anderson, N. J., Monographia Salicum (1867). Watson, S., Poplars of North America (Am. Jour. Sci. vol. 15, p. 135,—1878). Bebb, M. S., Review of the Willows of California (Bot. Gaz., vol. 16, p. 102,—1891). Rydberg, P. A., Cespitose Willows of Arctic America and the Rocky Mts. (Bull. N. Y. Bot. Gard. vol. 1, p. 257,—1899). Rowlee, W. W., North American Willows, Longifoliæ (Bull. Torr. Club. vol. 27, p. 247,—1900). Jones, M. E., Willow Family of the Great Plateau (1908).

Scales entire or merely denticulate, persistent; flowers without disk; stamens usually 1 to 5; stigmas short; pods small, ovate or narrow........1. Salix.
Scales fimbriate or lacerate, caducous; flowers with a broad disk; stamens usually numerous; stigmas elongated or conspicuously dilated; pods larger, nearly globose....2. Populus.

1. SALIX L. Willow.

Trees or shrubs with mostly narrow short-petioled leaves. Winter buds covered by a single scale. Catkins mostly erect, appearing before or with the leaves; scales entire or merely denticulate, persistent or at least not caducous. Staminate flowers with 1 to 9 stamens and 1 or 2 little glands. Pistillate flowers with a gland at the base of the ovary. Stigmas short.—Mainly north temperate and arctic, 160 species. (Ancient Latin name of the willow.)

Stamens 3 to 9, their filaments hairy or woolly below; style short; stigmas roundish, subentire; scales pale or yellowish, in the pistillate catkin more or less deciduous by maturity; capsules pediceled; trees, mainly of lower altitudes.
  Petioles with wart-like glands at summit; leaves lanceolate, long pointed; stipules usually present, roundish; catkins in bud tapering, in flower usually straight, their scales erect........1. *S. lasiandra.*
  Petioles not glandular; stipules usually absent; catkins in bud cylindric.
    Leaves broadly lanceolate, acute, usually glaucous beneath; staminate catkins curving; scales reflexed or spreading........2. *S. laevigata.*
    Leaves very narrow, nearly alike on both faces, finely serrulate, often curving towards apex........3. *S. nigra.*
Stamens 2, their filaments woolly or hairy below; scales pale, somewhat deciduous; catkins borne on short leafy branchlets, often clustered; leaves linear or lanceolate; shrubs of stream beds at lower altitudes.
  Stigmas linear, raised on a distinct style; ovary densely silky; leaves silvery or green........4. *S. sessilifolia.*
  Stigmas oblong or roundish, sessile.
    Capsule glabrous; leaves green, remotely serrulate........5. *S. longifolia.*

Capsule more or less pubescent; leaves more or less white-silky, entire.. *Var. argyrophylla.*
Stamens 2 (rarely 1), their filaments glabrous; stigmas entire or notched, rarely parted into linear lobes; scales usually black or dark-colored, mostly persistent.
Capsules glabrous.
Leaves dark green above, white-pubescent beneath; catkins sessile, leafless; filaments more or less united; small tree or shrub; foothills mainly, common.6. *S. lasiolepis.*
Leaves light green, nearly alike on both faces; catkins shortly peduncled and leafy bracteate; filaments distinct or partly united; montane, rare with us. ....7. *S. cordata.*
Capsules tomentose, silky or puberulent.
Style none.
Leaves obovate; catkin-scales black, with white hairs...........8. *S. flavescens.*
Leaves lanceolate; catkin-scales tawny ....9. *S. macrocarpa.*
Style evident.
Stamen 1, or if 2 the filaments partly united; stigmas linear; leaves conspicuously silky beneath ....10. *S. sitchensis.*
Stamens 2; stigmas short.
Montane species; good sized shrubs; leaves entire or nearly so.
Leaves glabrate beneath; catkins appearing with the leaves, borne on short leafy peduncles; Sierra Nevada ....11. *S. lemmoni.*
Leaves glaucous-pubescent beneath, long and narrow; catkins appearing before the leaves, sessile; inner South Coast Range......................12. *S. breweri.*
Alpine species; low shrubs or dwarfs.
Capsule shortly pediceled, at least pistillate catkins on short leafy branchlets.
Ovary hoary or finely tomentulose.
Leaves entire, usually green and glabrate....................13. *S. glauca.*
Leaves serrulate, usually gray-villous, the bract-like leaves glandular-serrulate ....14. *S. californica.*
Ovary glabrous; leaves bright green, dark veined..............15. *S. barclayi.*
Capsule sessile, 2 lines long; catkins short, sessile or subsessile......16. *S. monica.*
Capsule subsessile, 2 to 3 lines long; catkins terminal on short leafy branches; plant body forming a more or less dense mat.........................17. *S. tenera.*

1. **S. lasiandra** Benth. YELLOW WILLOW. Tree 20 to 45 feet high, the trunk with brown roughly fissured bark; one-winter-old branchlets yellowish; winter buds keeled on the back, short and blunt; young leaves lanceolate or oblanceolate, acuminate, glandular-serrulate, with small suborbicular stipules; mature leaves lanceolate with long tapering or very slender point, 4 to 7 inches long, ⅝ to 1¼ inches wide; petioles 3 to 9 lines long, glandular at the upper end; stipules on vigorous shoots conspicuous, orbicular, 5 to 12 lines broad; staminate catkins 1¼ to 3 inches long, usually straight, 5 to 6 lines thick; pistillate catkins 1¼ to 2¼ inches long, 2½ to 3 lines thick; scales erect, oblong-lanceolate, thin, nearly or quite glabrous on the back, hairy at base, the staminate yellow, the pistillate brown and mostly deciduous in fruit; stamens 4 to 9; ovary and capsule glabrous.

Banks of living streams throughout the Coast Ranges, Sacramento and San Joaquin valleys, and Sierra Nevada southward to Southern California and northward to British Columbia and Idaho. In the Sierra Nevada it is found chiefly in the foothills but ranges as high as 4,500 feet at the north and 8,500 feet at the south. Also called "Waxy Willow" and "Western Black Willow."

Refs.—SALIX LASIANDRA Bentham, Pl. Hartw. p. 335 (1857), type loc. Sacramento River between Sacramento and Marysville, *Hartweg;* Jepson, Fl. W. Mid. Cal. p. 136 (1901).

2. **S. laevigata** Bebb. RED WILLOW. Tree 20 to 50 feet high, the trunk bark roughly fissured; one-winter-old branchlets reddish brown; winter buds ovate, pointed; young leaves broadly oblong, acute at each end, disposed to be broadest above the middle, mucronate, entire, soon becoming serrulate;

stipules minute and caducous or none; mature leaves oblong-lanceolate to lanceolate, obtusish at base, acute at apex or sometimes long-pointed, serrulate, glabrous, green and shining above, pale or conspicuously glaucous beneath, 2½ to 7½ inches long, ⅝ to 1¼ inches broad; petioles 1 to 5 lines long; staminate catkins commonly flexuous, 1½ to 4½ inches long, 4 or 5 lines thick; pistillate catkins ¾ to 2 inches long, 2 lines thick; scales soon spreading or reflexed, elliptic, blunt, woolly at base, glabrous and pallid towards apex, 2 to 4-toothed, the staminate yellow, the pistillate gray and tardily deciduous; stamens 4 to 7 (sometimes 3); ovary and capsule glabrous.

Coast Ranges, Sacramento and San Joaquin valleys, Sierra Nevada (especially the foothills) and southward to Southern California. Usually along living streams, ranging altitudinally from near sea-level to 4,500 feet in the southern Sierra Nevada. Also called Bebb Willow, Smooth Willow and Spotted-leaf Willow. Extends north to southern British Columbia.

Forma **araquipa** Jepson n. form. Small tree; one-year-old shoot with dense close tomentum; brown tuft of hairs on old wood at base of season's shoot very conspicuous; leaves reddish brown above; catkins long and dense.—(Arbor parva ramulis annotinis cum denso appresso tomento; valde manifestus caespes fusci pili basi horni ramuli in ligno vetere; folia rufo-fusca supra; amenta longa artaque).—Dry gulches, Araquipa Hills, Solano Co., May 2-6, 1891, W.L.J.

Refs.—SALIX LAEVIGATA Bebb, Am. Nat. vol. 8, p. 202 (1874); Jepson, Fl. W. Mid. Cal. p. 136 (1901). Bebb had his original specimens from Santa Cruz, Ukiah and Alameda Co.

3. **S. nigra** Marsh. BLACK WILLOW. Tree commonly 20 to 50 feet high with rough dark bark; branchlets brittle at the base; mature leaves narrowly lanceolate, long-pointed, often falcate, serrulate, glabrous, green on both surfaces, 2 to 7 inches long, 2 to 4 (or 8) lines wide; petioles 1 line long; stipules early deciduous; scales of catkins obovate, yellow, hairy, erect; staminate catkins 1½ to 2½ inches long; stamens 3 to 5; pistillate catkins ¾ to 1¼ inches long, in fruit 1 to 2½ inches long, becoming rather lax; ovary scantily pubescent or hoary; capsule glabrous, reddish brown.

River banks in the Sacramento and San Joaquin valleys, extending into the lower Sierra Nevada foothills, ranging southward to Southern California and following the desert rivers across the Mojave to southern Arizona, thence eastward to the Mississippi Valley and north to New Brunswick. It has a more extensive range than any other tree in the United States except the Aspen.

Refs.—SALIX NIGRA Marsh, Arbust. Am. p. 139 (1785); Jepson, Fl. W. Mid. Cal. p. 136 (1901.)

4. **S. sessilifolia** Nutt. SANDBAR WILLOW. Shrub with slender stems 5 to 14 feet high, or becoming a tree up to 25 feet high; foliage silvery or becoming more or less green; leaves linear, usually tapering to the acute apex and to the narrow but short petiole-like base, entire, 1 to 3 inches long, 2 to 4 lines broad, thinly villous on both surfaces and green, or densely villous and silky, especially on young or sterile shoots; no stipules; catkins on leafy peduncles; staminate catkins ⅓ to 1 inch long, slender (2 lines thick), in bud usually cylindric, the scales with acute green tips; gland long and slender; pistillate catkin ¾ to 1 inch long, 3 lines broad, often not dense; ovary sessile, densely silky; style present, stigmas linear; capsule densely silky, or glabrescent and brown.

Abundant in stream beds of the Coast Ranges, Great Valley and Sierra Nevada foothills, ranging northward into Oregon.

Refs.—SALIX SESSILIFOLIA Nuttall, Sylva, vol. 1, p. 68 (1842), type loc. mouth of the Willamette River, *Nuttall*. *S. parishiana* Rowlee, Bull. Torr. Club, vol. 27, p. 249 (1900).

5. **S. longifolia** Muhl. LONGLEAF WILLOW. Shrub 5 to 15 feet high with bright green foliage; leaves mostly glabrous, or sometimes minutely canescent, lanceolate or linear, tapering to apex and to a short petiole at base, remotely serrulate with cuspidate teeth, ¾ to 5 inches long, 2 to 4 lines broad; catkins terminal on leafy branches; staminate catkins ½ to 1⅛ inches long, 2 lines thick; pistillate catkins ½ to 1 inch long; ovary pediceled or sometimes nearly sessile, glabrous; stigmas very short, sessile; scales densely woolly; capsule glabrous; fruiting catkin 1¼ to 2½ inches long.

Stream beds in valleys and foothills throughout the State and into the mountains to 4,000 feet, north to the Klamath River (W.L.J. no. 2952) and far eastward.

Var. **argyrophylla** And. COYOTE WILLOW. Slender shrub, stem one from the base, strictly erect or sometimes straggling, 4 to 12 feet high; foliage lustrous silvery or glabrescent and green; leaves linear, acute at apex or long-pointed, entire, ¾ to 2½ inches long, 1 to 2 lines wide; catkins on leafy peduncles; staminate catkins ⅓ to 1⅛ inches long, 3 lines thick, in bud usually conical, the green-tipped scales often abruptly acute; pistillate catkins ⅓ to ¾ inch long, 1½ to 2 lines thick; ovary silky; stigmas oblong, sessile, the top of the ovary sometimes bulbous-dilated just below them; capsule glabrescent, brown. —Stream beds, South Coast Ranges and northward to Oregon. Our description resting chiefly on Priest Valley plants (W.L.J. no. 2674) which in appearance more nearly resemble S. sessilifolia.

Refs.—SALIX LONGIFOLIA Muhlenberg in Ges. Naturf. Fr. Neue Schr. vol. 4, p. 238 (1803). *S. fluviatilis* Nuttall, Sylva, vol. 1, p. 73 (1842) is dubious. Nuttall collected his type on the banks of the Columbia River near the mouth of the Willamette. "At the present time the only species collected at or near that point are S. sessilifolia and S. exigua. * * * There is no Nuttallian type to represent this species in the Philadelphia Academy and it is therefore probably not in existence."—C. V. Piper in litt., 1908. *S. bolanderiana* Rowlee, Bull. Torr. Club. vol. 27, p. 257 (1900), with citation of Bolander's nos. 4958 (Yosemite Valley) and 5031 (Clarks, Merced River) as part of type, but no. 5031 also cited under S. exigua virens Rowlee, 1 c. p. 255, and no. 4958 under S. argophylla, p. 251, as if it were Brewer's number.

Var. ARGYROPHYLLA Andersson, Monog. Sal. p. 55 (1867), rests on Nuttall's *S. argophylla*. The original specimens of *S. argophylla* Nuttall, Sylva, vol. 1, p. 71, t. 20 (1842), were collected by Nuttall on the Boise River, Idaho, near its confluence with the Snake.

6. **S. lasiolepis** Benth. ARROYO WILLOW. Shrub or tree 10 to 18 or rarely 35 feet high, the trunk 3 to 7 inches in diameter with smooth bark or very old trunks shallowly seamed; mature leaves oblong, obovate or linear, acute, obscurely serrulate, dull green and glabrous above, white-pubescent or pale beneath, 1½ to 5 inches long, ⅓ to 1¼ inches broad; petioles 1 to 8 lines long; catkins appearing before the leaves, sessile, densely silky tomentose in the bud, suberect; scales dark; staminate catkins ¾ to 1½ inches long, 5 to 6 lines thick; stamens 2, filaments glabrous, distinct or united to the middle; pistillate catkins ¾ to 1 inch long, 3 to 4 lines thick, in fruit 1½ to 2¼ inches long; capsule glabrous or puberulent, short-pediceled.

Coast Ranges, Sacramento and San Joaquin valleys and Sierra Nevada foothills, northward to the Klamath River and southward to Southern and Lower California. The most common willow in the foothill country throughout the State, especially along summer-dry arroyos but also found on living streams. Also called White Willow.

Var. **bigelovii** Bebb. Leaves broadly obovate or cuneate-oblong, obtuse, entire, $\frac{3}{4}$ to $1\frac{3}{8}$ inches broad; catkins on short leafy peduncles.—San Francisco, where first collected by Bigelow, and elsewhere in the Bay region.

Refs.—SALIX LASIOLEPIS Bentham, Pl. Hartw. p. 335 (1857), type loc. Salinas and Carmel rivers, *Hartweg;* Jepson, Fl. W. Mid. Cal. p. 137 (1901). Var. BIGELOVII Bebb in Bot. Cal. vol. 2, p. 86 (1880); *S. bigelovii* Torrey, Pac. R. Rep. vol. 4, p. 139 (1857). *S. franciscana* Seeman, Bull. Torr. Bot. Club, vol. 30, p. 634 (1903), the type from "Cliff House, San Francisco." *S. bakeri* Seeman, l. c. p. 635, type from "foothills near Stanford University."

7. **S. cordata** Muhl. var. **mackenziana** Hook. MACKENZIE WILLOW. Shrub; leaves oblong-lanceolate, narrowed to the subcordate or truncate base and tapering into the pointed apex, entire or serrulate, glabrous, light green above, often glaucous beneath, 1 to $2\frac{1}{2}$ (or 4) inches long, $\frac{1}{2}$ to $\frac{3}{4}$ (or $1\frac{1}{2}$) inches broad; petioles 1 to 3 lines long; stipules orbicular, early deciduous or none; catkins subsessile or shortly peduncled, especially the pistillate, sparingly leafy-bracted, dense, 1 to $1\frac{1}{2}$ inches long, 3 to 4 lines thick; scales narrow, dark or black, the lower part villous with long white hairs; stamens 2, filaments glabrous, elongated, free or more or less united; style long, stigmas short, bifid; fruiting catkins 1 to $1\frac{3}{4}$ inches long; ovary and capsule glabrous; pedicel 1 line long.

High mountains: Sierra Nevada (Mariposa and Calaveras cos.); Lake Co. (acc. Bebb) and far northward. Apparently rare in California. Our form has shorter and less leafy peduncles than the type of the Rocky Mts.

Var. **watsoni** Bebb. Branches smooth, polished, yellow; leaves dark green, smaller, oblong, short-acuminate, serrulate or subentire, 1 to 3 inches long; stipules small or none; catkins 1 inch long, crowded.—High montane, 6,000 to 9,000 feet; San Jacinto Mt., northern Sierra Nevada and eastward to Utah.

Refs.—SALIX CORDATA Muhlenberg in Ges. Naturf. Fr. Neue Schr, vol. 4, p. 236 (1803), Var. MACKENZIANA Hooker, Fl. Bor. Am., vol. 2, p. 149 (1853). Var. WATSONII Bebb in Bot. Cal. vol. 2, p. 86 (1880); Jones, Willow Fam. Great Plateau, p. 13 (1908).

8. **S. flavescens** Nutt. NUTTALL WILLOW. Shrub 2 to 15 feet high or a small tree 25 feet high; branchlets with whitish or very dark bark; leaves broadly obovate or oblong-obovate, entire, rounded at apex or shortly acute, 1 to $1\frac{1}{2}$ (or 4) inches long, $\frac{1}{2}$ to $1\frac{1}{4}$ inches broad, yellow-green and lustrous above, yellow-veined, glabrate or densely short-silky beneath; petioles 4 lines long; catkins appearing before the leaves, oblong or elliptic, $\frac{1}{2}$ to 1 inch long, 5 to 7 lines thick, sessile; scales obovate, rounded at apex, black or black-tipped, covered with white hairs; stamens 2, conspicuously long-exserted, filaments glabrous; ovary white-silky; style none, stigmas broadly linear, sometimes notched at apex; capsule less silky than the ovary.

Sierra Nevada, 4,000 to 10,000 feet, and seaward Coast Ranges, southward to the San Bernardino Mts., northward to the Siskiyous (W.L.J. no. 2947), and far north to British Columbia and throughout the Rocky Mts. in the United States. Highly variable in both Coast Ranges and Sierra Nevada. The form found at Monterey (S. brachystachys Benth.) is matched by a like form in the Sierra Nevada. Type loc. Rocky Mts. lat. 39°, Thos. Nuttall (Wyeth Exped.).

Refs.—SALIX FLAVESCENS Nuttall, Sylva, vol. 1, p. 65 (1842), not of Host; Bebb in Bot. Cal. vol. 2, p. 86 (1880), in part. *S. nuttallii* Sargent, Gard. & For. vol. 8, p. 463 (1895). Var. *brachystachys* Sargent, Silva N. Am. vol. 9, p. 142 (1896); Jepson, Fl. W. Mid. Cal. p. 137 (1901).

9. **S. macrocarpa** Nutt. var. **argentea** Bebb. SILVER WILLOW. Slender shrub 6 to 16 feet high with numerous stems from the base and very slender

pruinose branchlets; leaves lanceolate, acute at base, acuminate at apex, 1 to 1½ inches long, 2 to 5 lines wide, becoming green above, appressed silky beneath and imparting a silvery sheen, or glabrate and pale; petioles 1 to 3 lines long; catkins short-peduncled with 2 or 3 leafy bracts, the staminate 4 to 6 lines long and 3 lines thick, the pistillate 3 to 4 lines long and 1½ to 2 lines thick; scales dark or yellowish, rounded; filaments glabrous; style none or very short; ovary hoary; stigmas ovate, entire or emarginate; fruiting catkins ½ to ¾ inch long, about as thick; capsules 2 to 3 lines long, light brown, puberulent, pediceled.

Sierra Nevada, 7,000 to 9,000 feet: Volcano Creek, common in and about the meadows in the Mt. Whitney region, W.L.J. no. 952; Mono Co., Congdon, and northward to Oregon and Idaho. The specific name, macrocarpa, is misleading since the capsules are not large.

Refs.—SALIX MACROCARPA Nuttall, Sylva, vol. 1, p. 83 (1842), type loc. banks of Columbia River, *Nuttall;* Bebb in Bot. Gaz. vol. 10, p. 221 (1885). Var. ARGENTEA Bebb, l. c. p. 223 (the types from Sierra and Plumas cos.), and in Bot. Death Val. Exped. p. 199 (1893). *S. geyeriana* Andersson, Oefvers. Vet. Akad. Foerhandl. vol. 15, p. 122 (1858); Bebb in Bot. Cal. vol. 2, p. 87 (1880). *S. covillei* Eastwood in Zoe, vol. 5, p. 80 (1900), type from Bubbs Creek, South Fork Kings River (not seen by us); the author of this proposition makes the statement that "it is so unlike that species [S. macrocarpa argentea] that it would be a waste of time to enumerate the differences."

10. **S. sitchensis** Sanson. SITKA WILLOW. Arborescent or shrubby, 5 to 25 feet high, the trunk 2 to 10 inches in diameter; leaves obovate to oblanceolate, rounded or shortly acute at apex, entire (obscurely serrulate on vigorous shoots), dark green and almost glabrous above, densely tomentose and lustrous silky beneath, 2 to 5 inches long, 1 to 3 inches broad; petioles 1 to 6 lines long; stipules small, early deciduous or on sterile shoots broad or orbicular, 4 to 6 lines long; staminate catkins 1¼ to 2 inches long, 5 to 6 lines thick; stamens 1, or exceptionally 2 and their filaments more or less united; pistillate catkins ¾ to 2 inches long and 3 lines thick, or in fruit 3 to 5 inches long; scales covered with long white silky hairs, the staminate rounded at apex, the pistillate shorter, broader and more acute; style elongated, stigmas short-oblong, entire or nearly so.

Immediate coast region from Santa Barbara to Marin and Humboldt cos., far north to Alaska (type loc. Sitka) and east to Blue Mts. of Oregon. Also called Silky Willow.

Forma **coulteri** Jepson, n. comb. (S. coulteri And.). Leaves coriaceous, densely woolly beneath, 2 to 3 inches long; stipules 3 or 4 lines long.—San Francisco, Bolander, no. 2451 and southward.

Forma **ralphiana** Jepson n. form. Leaves narrowly oblong, white beneath with a fine dense felt, 2 to 3½ inches long, 6 to 10 lines wide; stipules small; catkins about 2 inches long.—(Folia anguste oblonga, subtus alba, coacta tenui densaque prædita, 2 ad 3½ poll. longa, 6 ad 10 lin. lata; stipulæ parvæ; amenta circa 2 poll. longa).—Marble Fork of the Kaweah, 6,900 feet, W.L.J. no. 690. Named for Ralph Hopping, naturalist on the Kaweah North Fork.

Forma **parvifolia** Jepson n. form. Leaves oblanceolate, acute, ¾ to 1¼ inches long, 3 to 4 lines wide; stipules minute.—(Folia oblanceolata, acuta, ¾ ad 1¼ poll. longa, 3 ad 4 lin. lata; stipulæ minutæ).—Melbourne to Comptche, Mendocino Co., W.L.J. no. 2229.

Var. **angustifolia** Bebb. Leaves narrowly oblanceolate, acute or acuminate, 1 to 2 inches long, 3 to 4 lines wide, the margin revolute; stipules none; fruiting catkin 1 inch long.—Donner Pass, according to Bot. Cal., vol. 2, p. 87.

Refs.—Salix sitchensis Sanson in Bongard, Veg. Sitch. p. 162 (1831); Jepson, Fl. W. Mid. Cal. p. 137 (1901). Var. angustifolia Bebb in Bot. Cal. vol. 2, p. 87 (1880). *S. coulteri* Andersson in Oefvers. Vet. Akad. Foerhandl, vol. 15, p. 119 (1858); Bebb in Bot. Cal. vol. 2, p. 90 (1880).

11. **S. lemmoni** Bebb. Lemmon's Willow. Shrub 5 to 13 feet high; leaves lanceolate, acuminate at both ends, entire, green, nearly alike on both faces, glabrous or nearly so, dark-veined, 1 to 1½ inches long, 3 lines broad; petioles 1 or 2 lines long; stipules small, soon deciduous; catkins ½ inch long on very short peduncles with 2 or 3 foliaceous bracts; scales pitch-black, usually rounded, villous; stamens 2, filaments slightly puberulent at base; style short, stigmas short-linear, entire; ovary and capsule grayish tomentose or the latter glabrate; pedicels in fruit ½ to ¾ line long.

Sierra Nevada, 7,000 to 8,000 feet altitude from Mariposa Co., Congdon, northward to Plumas Co., and Washoe Co., Nevada; Wasatch Mts., Utah; eastern Oregon. First collected by J. G. Lemmon, a pioneer Californian botanist, in Sierra Co. The staminate flowers exceptionally bear 4 stamens, the filaments partly united in pairs, or 1 pair distinct.

Refs.—Salix lemmoni Bebb in Bot. Cal. vol. 2, p. 88 (1880), Bot. Gaz. vol. 16, p. 106 (1891); Jones, Willow Fam. Great Plateau, p. 16 (1908). *S. austinae* Bebb in Bot. Cal. vol. 2, p. 88 (1880), Bot. Gaz. vol. 16, p. 106 (1891); this name was founded on a mixture of material representing S. lemmoni and one or two other species.

12. **S. breweri** Bebb. Brewer Willow. Shrub; young leaves oblong, shortly acute, entire, white-pilose above but soon becoming green except along the midrib, white below with a close tomentum, ⅝ to 1 inch long, 2 to 3 lines wide; mature leaves green and puberulent above, rugose beneath and whitened with a thin but dense felt-like covering, entire, 2 to 2½ inches long, 3 to 4 lines wide; petioles almost none; stipules of sterile shoots small, ovate, acute; catkins appearing before the leaves, dense, ¾ inch long, 3 to 4 lines thick, sessile, with 2 or 3 small bracts at base; scales yellow, rounded at apex, rather densely pilose on both sides; stamens 2; filaments glabrous; nectary filiform, very long; ovary and capsule hoary; style elongated, stigmas 2-cleft.

San Carlos Range: Mt. San Carlos, W. H. Brewer, no. 788, July 23, 1861, 3,500 feet altitude (type loc.); headwaters of San Benito River, low crouching shrub along water's edge, W. L. Jepson, no. 2709, May 12, 1907, 4,000 feet altitude. Not otherwise known.

Ref.—Salix breweri Bebb in Bot. Cal. vol. 2, p. 88 (1880).

13. **S. glauca** L. var. **villosa** And. Shrub 2 to 4 feet high; leaves oblong-lanceolate, acute or taper-pointed, entire, green above, slightly glaucous beneath, pubescent or subglabrous, when young villous tomentose, 1 to 2½ inches long, 3 to 7 lines wide; petioles almost none to 3 lines long; stipules lanceolate or none; catkins ½ to ¾ inch long, on leafy-bracteate peduncles, the staminate peduncles very short or almost none; scales hairy, dark, turning reddish; stigmas entire or 2-lobed; fruiting catkins ¾ to 1½ inches long; ovary hoary or tomentulose; capsule brown, finely pubescent, 3 to 4 lines long.

Sierra Nevada, 8,000 to 11,000 feet altitude: Farewell Gap, W.L.J. no 1150; Bullfrog Lake, South Fork Kings, W.L.J. no. 851; San Joaquin, South Fork, Hall & Chandler; Chilnualna Trail, Mariposa Co., J. W. Congdon, northward and far northward.

Refs.—Salix glauca Linnaeus, Sp. Pl. 1019 (1853). *S. villosa* Don in Hooker, Fl. Bor.

Am. vol. 2, p. 144 (1853), the type being from the northern Rocky Mts., coll. by Drummond. Var. VILLOSA Andersson, Sal. Bor. Am. p. 22 (1858). *S. glaucops* Andersson in DeCandolle, Prodr. vol. 16, pt. 2, p. 281 (1868).

14. **S. californica** Bebb. SIERRA WILLOW. Shrub 2 to 5 feet high, closely related to the preceding; leaves mostly oblong, acute at apex obtuse at base, appressed-villous and gray (or the young parts densely white tomentose), often glabrescent and green, finely glandular serrate, ¾ to 2 inches long, 5 to 9 lines broad; margin of small leaves at base of both leafy and flowering shoots thickly studded with glands; stipules ovate, lanceolate or none; catkins on short leafy peduncles, the staminate ½ inch, the pistillate ½ to 1 inch long (in fruit 1 to 1½ inches long); scales dark, villous; ovary hoary-tomentose; style elongated, stigmas oblong, bifid or entire; capsule brown, finely pubescent, 2 to 3 lines long.

Sierra Nevada, 7,000 to 9,000 feet: House Meadows on North Fork Kings River; Mt. Goddard; Crescent Lake, Mariposa Co.; Yosemite National Park; Soda Springs of the Tuolumne; Summit, Placer Co.; near Mt. Lola, Nevada Co. No more than a subspecies or variety of the preceding it is distinguishable only by its glandular-serrate leaves which are, however, sometimes entire on the same branch.

Ref.—SALIX CALIFORNICA Bebb in Bot. Cal. vol. 2, p. 89 (1880).

15. **S. barclayi** And. BARCLAY WILLOW. Dwarf shrub; leaves white-tomentose when young, soon green, dark-veined, narrowly obovate, obtuse or bluntly acute, tapering to the shortly petioled base, entire or sometimes serrulate, ½ to 1½ inches long; catkins on short leafy peduncles, dense, ¾ to 1½ inches long, 4 to 5 lines broad, the scales very black and covered with long white pilose hairs; stamens 2, filaments sometimes united ⅓ their length; ovary and capsule glabrous or nearly so, green, pediceled; style long, stigmas 2-lobed.

Subalpine: Marble Mt., Siskiyou Co., 6,000 feet; Warner Mts., Modoc Co.; northward into Oregon and far northward.

Refs.—SALIX BARCLAYI Andersson, in Oefvers. Vet. Akad. Foerhandl. vol. 15, p. 125 (1858); Bebb in Bot. Death Val. Exped. p. 198 (1893); Jones, Willow Fam. Great Plateau, p. 16 (1908).

16. **S. monica** Bebb. MONO WILLOW. Procumbent or erect branching shrub, 1 to 2 feet high; branchlets dark red; leaves ovate, acute at apex, acutish at base, ostensibly entire but obscurely and remotely serrulate, bright green above, somewhat pale below, glabrous or nearly so, ⅓ to 1½ inches long, 3 to 7 lines broad, rather conspicuously feather veined, the veins dark or black; petioles 1 to 3 lines long; stipules none; scales roundish ovate, hairy; catkins small and short, densely flowered, sessile or subsessile; bracts none or few and small; fruiting catkins ¾ inch long; style medium sized, stigma usually entire; capsule brown, glabrate, sessile or subsessile, 2 lines long.

Sierra Nevada, local in the Tuolumne Meadows region, 9,000 to 11,000 feet altitude: Mono Pass, Mono Co., W. H. Brewer, no. 1732 (1863), J. W. Congdon (1894); Soda Springs of the Tuolumne, J. W. Congdon (1898); Yosemite National Park, Katherine Jones (1907). Obscure and little known species, possibly referable to some northern type.

Refs.—SALIX MONICA Bebb in Bot. Cal. vol. 2, p. 90 (1880), Bot. Gaz. vol. 16, p. 107 (1891).

17. **S. tenera** And. ALPINE WILLOW. Stems with very short often tortuous branches forming a depressed or prostrate plant body 1 to 4 inches high; flowering shoots 1 to 6 inches high; leaves oblong and acute, ovate-lanceolate,

entire, scantily pilose, ¼ to 1 or 1½ inches long, 2 to 5 lines broad; catkins on erect leafy peduncles, densely flowered, ⅓ to ¾ inch long, the pistillate 1 to 2 inches long; peduncles in fruit 1 to 2 inches long; style long, stigmas 2-cleft; capsules white woolly or glabrescent and brown, subsessile, 2 to 3 lines long.

Sierra Nevada, 9,000 to 11,000 feet: Mt. Whitney (southernmost locality), Mt. Brewer, Mt. Goddard, Mt. Lyell, Mt. Dana, and other high peaks and far northward to the Arctic Circle.

Refs.—Salix tenera Andersson in DeCandolle, Prodromus, vol. 16, pt. 2, p. 288 (1868), the type from the Cascade Mts., lat. 49°, 7,000 feet, *Lyall*. *S. arctica* Pallas var. *petraea* And. l. c. p. 287. *S. petrophila* Rydberg, Bull. N. Y. Bot. Gard. vol. 1, p. 268 (1899).

2. **POPULUS** L. Poplar.

Trees with scaly buds and caducous stipules. Leaves rather long-petioled, broad. Winter buds covered by many scales. Catkins appearing before the leaves, in ours pendulous; scales imbricate or lacerate, falling as soon as released by the flowering elongation of the catkin. Stamens inserted on the surface of a concave disk. Ovary seated on a collar-like disk; style short; stigmas 2 to 4, narrow and elongated, or conspicuously dilated. Capsule 2 to 4-valved. Coma of the small seeds long and conspicuous.—North temperate zone, 18 species. (Classical Latin name of the Poplar.)

Stamens 40 to 80.
  Leaves deltoid-orbicular, broader than long, yellowish green, alike on both faces; valley streams ....1. *P. fremontii.*
  Leaves longer than broad, ovate, dark green above, rusty or silvery beneath; valley and mountain streams ....2. *P. trichocarpa.*
Stamens 6 to 12; leaves round-ovate, 1 to 2 inches long; high mountains..3. *P. tremuloides.*

1. **P. fremontii** Wats. Common Cottonwood. Handsome tree commonly 40 to 90 feet high with massive crown, the trunk 1 to 5 feet in diameter; bark white or whitish, on the main trunk 1 to 5 inches thick, roughly cracked; leaves triangular or roundish in outline, 2 to 4 inches broad, broader than long, the margin crenate except at the abruptly short-pointed apex and the truncate or subcordate base; scales regularly laciniate-fringed, shorter than the flowers; staminate catkins 2 to 4 inches long, densely flowered, each flower with 48 to 72 stamens; pistillate catkins 2 inches long (becoming twice as long in fruit), loosely flowered; ovary sinuously and strongly ridged about its middle and surmounted by 3 or 4 roundish stigmas; mature pods ovate, roughish on the surface, 4 to 5 lines long, borne on pedicels 2 lines long, opening by 3 or 4 valves; seeds copiously provided with long white hairs which soon involve the catkin in a soft cottony mass.

Valleys and foothills, usually along living streams: common in the Sacramento Valley from near Redding southward through the San Joaquin Valley, Lower Sierra Nevada foothills and South Coast Ranges to Southern California and Mexico and far eastward to southern Colorado. Shunning the Redwood Belt and very rare in the North Coast Ranges where thus far noted only at the following localities: near Round Valley; fork of Eel River in northern Lake Co.; Russian River from Cloverdale to Ukiah. Not seen in Napa Valley nor in the valley of San Francisco Bay from San Rafael and San Pablo to Decoto. Most abundant and of greatest size on the Kaweah Delta. Valuable shade and roadside tree in hot interior valleys. Also called Fremont Cottonwood.

Refs.—Populus fremontii Watson, Proc. Am. Acad. vol. 10, p. 350 (1875), type loc. Deer

Creek, Tehama Co., *Fremont;* Havard, Gard. & For. vol. 3, p. 620 (1890); Merriam, N. Am. Fauna, no. 7, p. 335 (1893); Jepson, Fl. W. Mid. Cal. p. 138 (1901).

2. **P. trichocarpa** T. & G. BLACK COTTONWOOD. Tree commonly 30 to 125 feet high, with a broad head of upright branches; trunk 1 to 3 feet in diameter; bark light or dark in color but usually with a yellowish cast, longitudinally fissured, the long, narrow and rather smooth-surfaced plates separated by cleanly channeled fissures; leaves broadly or narrowly ovate, finely serrate, truncate or heart-shaped at base, acute or tapering to a point at apex, 2½ to 7 (or 11) inches long, lustrous green above, rusty-brown beneath when young but at length whitish; staminate catkins 1 to 2 or eventually 5 inches long, each flower with 40 to 60 stamens on a slightly one-sided disk; anthers light purple; pistillate catkins loosely flowered, 2½ to 3 inches long and 4 to 10 inches long in fruit; ovary crowned by 3 dilated and deeply lobed stigmas; pod nearly sessile, 3-valved; seeds with long lustrous white hairs.

Living streams in cañons and valleys: Sierra Nevada, 3,000 to 8,000 feet, common along streams and on such cañon floors as Kern, Kings and Yosemite; South Coast Ranges in the Mt. Diablo, Mt. Hamilton, Santa Cruz and Santa Lucia ranges and southward to the San Bernardino and San Jacinto mts., the most southerly locality on Palomar at Cootea (San Diego Co.); North Coast Ranges from northern Lake Co. westerly to Long Valley and Petrolia, and northward to Trinity Summit, Salmon, Shasta and Klamath rivers; far northward to Alaska. Most abundant on the Oregon and Washington coasts where it is lumbered for staves and woodenware. It is the tallest species in the genus. Winter buds covered with a balsam resin wherefore also called "Balm" and "Balsam Cottonwood."

Var. **cupulata** Wats. Disk campanulate, pubescent, twice longer than ovary. —Plumas Co., according to Bot. Cal., vol. 2, p. 91.

Forma **ingrata** Jepson n. form. Leaves lanceolate, 2 to 4½ inches long, 4 to 10 lines broad.—(Folia varia valde, lanceolata in typo, 2 ad 4½ poll. longa, 4 ad 10 lin. lata).—San Bernardino Mts., upper Santa Ana Cañon, mouth of north fork, H. M. Hall, no. 7517. A singular type but connected with the usual form by several transition states.

Refs.—POPULUS TRICHOCARPA T. & G. in Hooker, Icon. vol. 9, pl. 878 (1852), type loc. Santa Clara River, Ventura Co., *C. C. Parry;* Jepson, Fl. W. Mid. Cal. p. 138 (1901).

3. **P. tremuloides** Michx. ASPEN. Slender tree with branches gracefully pendulous towards the ends, 10 to 60 feet high, the trunk 3 to 10 inches in diameter, bark smooth, greenish white, or on old trunks nearly black; leaves round-ovate, finely toothed or almost entire, abruptly tipped at apex with a short sharp point, 1 to 2 inches long; staminate catkins 1½ to 2½ inches long, each flower with 6 to 12 stamens; pistillate catkins 2 to 4 inches long; ovary conical; stigmas 2, very thick below, divided above into 2 slender spreading lobes; style short and thick; seeds minute, brownish, bearing long white hairs.

Sierra Nevada, margins of streams or swampy meadows or on rocky drifts, 5,000 to 10,000 feet: Kern Cañon; Mineral King; Giant Forest; Bubbs Creek; North Fork Kings River; South Fork San Joaquin; Yosemite National Park and frequent northward to Donner and Modoc Co. Not known on Mt. Shasta and locally noted elsewhere in the State only in the Trinity Mts. (Cañon Creek) and San Bernardino Mts. (Fish Creek Cañon, San Gorgonio Peak, Jos. Grinnell, the leaves less than 1 inch long and broader than long). Ranges east to the Rocky Mts., south to Mexico, north to Alaska, across the continent to Labrador, thence south to Tennessee. It has a more extensive distribution than any other North American tree. Occurs only in small scattered thickets in California but forming extensive pure forests in the Rocky Mts. Wood burns green.

Refs.—POPULUS TREMULOIDES Michaux, Fl. Bor. Am. vol. 2, p. 243 (1803); Sudworth, 21st Rep. U. S. Geol. Sur. pt. 5 (For. Res.), pp. 517, 542 (1900).

BETULACEAE. BIRCH FAMILY.

Wind-pollinated trees or shrubs with alternate simple petioled leaves and caducous stipules. Flowers small, borne in catkins. Staminate catkins elongated, pendulous, falling after flowering, the flowers in clusters of 3 in the axil of each bract, consisting of a membranous commonly 4-parted calyx and 1 to 7 (commonly 2 or 4) stamens; bracts dilated above with the apex abruptly upturned, each covering 4 bractlets. Pistillate catkins small, erect, spike-like, the flowers 2 in the axil of each bract, without perianth, consisting of a pistil with 2 styles and a 2-celled ovary with 1 ovule in each cell. Fruit a very small compressed 1-seeded nutlet which is margined or winged.—Two genera.

Bibliog.—Parry, C. C., Pacific Coast Alders (Bull. Cal. Acad., vol. 2, p. 351,—1887). Winkler, H., Betulaceæ (Das Pflanzenreich, bd. 4, lief. 61,—1904).

Pistillate catkins in clusters, forming in fruit oval or ovoid woody cones which are drooping or spreading, their scales obscurely 5-lobed at apex; stamens 1 to 7........1. ALNUS.
Pistillate catkins solitary, cylindrical and erect in fruit, falling to pieces when mature, their scales plainly 3-lobed at apex; stamens 2..............................2. BETULA.

1. ALNUS L. ALDER.

Peduncles branched or forked, bearing a cluster of few to several catkins. Calyx of staminate flower 4 (or 6)-parted; stamens 1 to 7. Pistillate catkins in clusters of 2 to 4, forming woody pendulous cones when mature, the bracts and bractlets united into 5-lobed scales which are persistent on the axis. Nutlet with a narrow acute margin.—North temperate regions, a few ranging in the high mountains to Bolivia; about 18 species, 9 in North America. (Alnus, the ancient Latin name.)

Catkins appearing in the early autumn as rather conspicuous naked buds, and flowering in the late winter or early spring before the leaves appear; peduncles of the pistillate catkins naked, their branches ½ inch long or less; sepals 4; stamens 1 to 4.
  Trees 30 to 80 feet high; mostly of low altitudes.
    Leaf-margin plane, with small scattered teeth; bracts of staminate catkin obtuse; stamens 1 to 3, rarely 4 ....1. *A. rhombifolia.*
    Leaf-margin with narrowly revolute edge, rather coarsely toothed; bracts of staminate catkins acute or acutish; stamens 4, rarely 3 ....2. *A. rubra.*
  Shrubs 8 to 15 feet high; leaf-margin coarsely toothed and again finely toothed; stamens 4 or 2; high montane ....3. *A. tenuifolia.*
Catkins appearing in the spring from scaly buds at the same time as the leaves; peduncles of the pistillate catkins leafy (at least at base), their branches ½ to 1 inch long; sepals 6; stamens 6 or 7; leaf-margin sharply or laciniately toothed; high montane shrub ....4. *A. viridis.*

1. **A. rhombifolia** Nutt. WHITE ALDER. (Fig. 61.) Tree commonly 30 to 80 feet high with whitish or gray-brown bark; trunks ½ to 3½ feet in diameter; leaves 2 to 4 inches long, minutely pubescent, elliptic and obtuse, or more commonly oblong-ovate or oblong-rhombic and tapering more or less to the apex, at base broadly wedge-shaped and entire, the remainder of the margin provided with small and more or less unequal glandular teeth; staminate catkins in

clusters of 2 to 7, slender, 2 to 3 (or 5) inches long; sepals 2 to 4, most commonly 3, often unequal, one usually very small when the number is 4; stamens 2, less commonly 3; pistillate catkins 3 to 7 in a cluster, erect or ascending, 5 to 6 lines long, in fruit becoming ovoid and 5 to 9 lines long; nutlets flattened, 1 line broad.

Banks of rivers and perennial streams: Sierra Nevada cañons; Sacramento and San Joaquin valleys; Coast Ranges except in the narrow coast strip occupied by the Red Alder; cismontane Southern California as far south as the Cuyamaca Mts.; northward to the Cascades of Washington (eastern slope) and northern Idaho. Grows in the lower Sacramento country within a few feet of sea-level, thence practically continuous to 6,500 feet and 8,000 feet in the southern Sierra Nevada, a remarkable altitudinal range.

Refs.—ALNUS RHOMBIFOLIA Nuttall, Sylva, vol. 1, p. 33 (1842), type loc. vicinity of Monterey, *Nuttall;* Watson in Bot. Cal. vol. 2, p. 80 (1880), in part; Jepson, Fl. W. Mid. Cal. p. 139 (1901). *A. oblongifolia* Watson in Bot. Cal. vol. 2, p. 80 (1880) in part.

2. **A. rubra** Bong. RED ALDER. Tree commonly 30 to 90 feet high, usually with very white or white-mottled bark; trunk unbranched for 15 to 60 feet, 1 to $2\frac{2}{3}$ feet in diameter; leaves 2 to 6 inches long, elliptic-ovate, often rusty beneath, with coarse teeth which are again finely toothed, the entire margin with a narrow underturned edge; staminate catkins stoutish, 3 to 7 inches long; calyx with 4 stamens, but sometimes with 3, especially at upper end of catkin; pistillate catkins 4 to 6 lines long, maturing into oblong-ovoid cones $\frac{3}{4}$ to $1\frac{1}{8}$ inches long; nutlets flattened, acutely margined or some narrowly winged, roundish, 1 to $1\frac{1}{2}$ lines broad.

Deep cool cañons or moist flats from the Santa Inez Mts. north to the Santa Cruz Mts., Oakland Hills, Point Reyes Peninsula, and so on along the coast far north to southern Alaska. With us most abundant in Marin, Mendocino and Humboldt cos., where it forms pure groves of singular beauty in marshy bottoms near the sea. Wood used for fish-barrels, bungs for oak-barrels, buggy-boxes, brake-blocks and in cabinet work.

Refs.—ALNUS RUBRA Bongard, Veg. Sitcha, p. 162 (1833), the type coll. by R. H. Mertens at Sitka. *A. oregona* Nuttall, Sylva, vol. 1, p. 28, pl. 9 (1842); Jepson, Fl. W. Mid. Cal. p. 139 (1901).

3. **A. tenuifolia** Nutt. MOUNTAIN ALDER. Small tree or shrub 8 to 14 feet high; leaves roundish to ovate, thickish, at base truncately rounded (or even subcordate) to cuneate, coarsely toothed and again finely serrate, 1 to 3 inches long; staminate catkins 3 or 4 in a cluster, 3 inches long; stamens 2 to 4, not exceeding the 4 sepals; pistillate catkins 3 to 8 in a cluster, sessile or with peduncles almost 2 lines long; cones small, 3 to 7 lines long.

Sierra Nevada from Donner Pass northward to Mt. Shasta, thence westward to Trinity Summit (W.L.J. no. 2058) and the Siskiyous, forming thickets on wet hillsides or in moist hollows at 5,000 to 7,000 feet. Ranges north to the Yukon Territory, thence south through the Rocky Mts. to New Mexico. Also in Lower California.

Refs.—ALNUS TENUIFOLIA Nuttall, Sylva, vol. 1, p. 32, t. 10 (1842), the original specimens from the Rocky Mts., and Blue Mts. of Oregon, *Nuttall. A. incana* var. *virescens* Watson in Bot. Cal. vol. 2, p. 81 (1880).

4. **A. viridis** DC. var. **sinuata** Regel. THIN-LEAF ALDER. Slender shrub 6 to 10 feet high; leaves round ovate, thin, gummy when young, bright green, sharply or laciniately toothed, $2\frac{1}{4}$ to 3 inches long; catkins appearing in spring at the same time as the leaves, the peduncles of the pistillate leafy at least at

base, their branches ½ to 1 inch long; staminate catkins yellowish green, a distinct purple spot on the ends of the bracts; sepals 6; stamens 6 or 7.

Subalpine in northern California, occurring on Trinity Summit (W.L.J. no. 2110) and Mt. Shasta, at about 6,500 to 7,000 feet, thence ranging far northward.

Refs.—ALNUS VIRIDIS DeCandolle, Fl. Fr. vol. 3, p. 304 (1805). Var. SINUATA Regel, Gatt. Bet. und Alnus, p. 422 (1865). *A. sinuata* Rydberg, Bull. Torr. Club, vol. 24, p. 190 (1897).

2. BETULA L. Birch.

Staminate catkins 1 to 3 in a cluster, sessile or short-peduncled; calyx 4 (or 2)-lobed; stamens 2, the filaments shortly forked at apex, each fork with an anther-cell. Pistillate catkins solitary on the peduncle and erect, each scale consisting of the bract and 2 bractlets united; scales falling away from the axis when the fruit is mature. Nutlet seed-like, with a broad thin wing.—Chiefly far northern regions (no other tree reaches so far north as the Canoe Birch which goes to 66° N. lat.); about 35 species.

Leaves 1 to 2 inches long; lobes of bracts broad, usually parallel, acutish. .1. *B. occidentalis.*
Leaves ½ to 1 inch long; lobes of bracts narrow, divergent, obtusish......2. *B. glandulosa.*

1. **B. occidentalis** Hook. Water Birch. Slender tree 10 to 25 feet high, with red-brown smooth bark and warty twigs; leaves round ovate, sharply serrate, mostly acute at apex, almost or quite glabrous and 1 to 2 inches long; petioles 4 or 5 lines long; staminate catkins 2 to 2½ inches long; pistillate catkins 1½ inches long in fruit and 3 or 4 lines in diameter; nutlets 1 to 1½ lines broad.

Sierra Nevada, east slope from near Walker Pass northward, common in the cañons west of Owens Lake (W.L.J. no. 905); noted on the west slope only on Bubbs Creek (W.L.J. no. 807) and near Simpson's Meadow. Siskiyous south to Grouse Creek, Humboldt Co., and north to British Columbia and east to Montana.

Forma **inopina** Jepson n. form. Tree 15 feet high; young branches rather densely hairy; pistillate catkins 1 inch long and 2 lines in diameter in fruit.—(Arbor 15 ped. alta, ramis juvenilibus subdense pilosis; amenta feminina 1 poll. longa et in fructo 2 lin. in diametro).—Forks of Salmon River to Cecilville, western Siskiyou, W.L.J. no. 2083, July 19, 1902.

Refs.—BETULA OCCIDENTALIS Hooker, Fl. Bor. Am. vol. 2, p. 155 (1853); Winkler, Engler's Pflanzenreich, vol. 4, pt. 61, p. 86 (1904). *B. fontanalis* Sargent, Bot. Gaz. vol. 31, p. 239 (1901). *B. alba,* forma *occidentalis* Fernald, Am. Jour. Sci. ser. 4, vol. 14, p. 173, t. 5, f. 3 (1902).

2. **B. glandulosa** Michx. Scrub Birch. Shrub 1 to 4 feet high with glandular-warty twigs; leaves roundish, serrate, ½ to 1 inch long; pistillate catkins 4 to 9 lines long; nutlet 1 line broad.

High mountains of northern Sierra Nevada (Bridge Creek, Lassen Co.), Warner Range (Modoc Co.), and northward to subarctic regions where it covers vast tracts of country.

Ref.—BETULA GLANDULOSA Michaux, Fl. Bor. Am. vol. 2, p. 180 (1803), type loc. Lake Mistasinnis, Labrador.

CORYLACEAE. Hazel Family.

Shrubs or bushes with alternate simple leaves. Staminate flowers in catkins without perianth; stamens 4 (seemingly 8) with forked filaments, each fork bearing one cell of an anther, the undivided portion of the filament cohering more or less with the scale or obsolete. Pistillate flowers several in a scaly bud, 2 to each bract; each flower with a very small laciniate-fringed posterior and anterior bractlet; perianth minute, adnate to the 2-celled ovary and without limb; style short; stigmas slender, elongated. Bractlets in fruit much enlarged and foliaceous, forming a tubular involucre enclosing the nut.—Four genera.

1. **CORYLUS** L. Hazel.

Leaves broad, thin, serrulate or incised. Staminate catkins pendent, cylindrical, single or fascicled, from scaly lateral buds, the pistillate clusters of flowers terminal and lateral on the same branchlets. Flowers appearing before the leaves.—North Temperate Zone, 7 species. (Ancient Greek name.)

1. **C. rostrata** Ait. var. **californica** A. DC. California Hazel. Most commonly 6 to 10 feet high; leaves obovate to roundish, rounded at apex or shortly acute, sometimes obscurely 3-lobed above middle, glandular-pubescent or villous, $1\frac{1}{2}$ to 4 inches long; anthers with a sparse tuft of hairs at apex; involucre densely hispid, prolonged beyond the nut into a laciniately fringed tube 1 inch long, or sometimes very short ($\frac{1}{4}$ inch long); nut ovoid, bony, 6 lines long.

Along streams in cool cañons or on moist slopes: Coast Ranges from the Santa Cruz Mts., Oakland Hills, Marin Co. and Napa Co., northward to Mt. Shasta; Sierra Nevada, 2,500 to 5,000 feet, Marble Fork Kaweah (W.L.J. no. 686) northward. Not seen in Vaca Mts. nor in San Carlos or Santa Lucia ranges. The Eastern C. rostrata has long-pointed leaves. The Californian plant has leaves rounded at apex but does not differ in pubescence nor in tube of involucre which is often as long and narrow as in Eastern type. Two and three-year-old shoots furnish the Indian women with the twigs they most commonly employ for the ribs of baskets.

Refs.—CORYLUS ROSTRATA Aiton var. CALIFORNICA A. DeCandolle, Prodr. vol. 16, pt. 2, p. 133 (1864), type loc. woods near Santa Cruz, *Hartweg;* Jepson, Fl. W. Mid. Cal. p. 140 (1901). C. *californica* Heller, Bull. Torr. Club, vol. 25, p. 580 (1898).

FAGACEAE. Oak Family.

Trees or shrubs with alternate simple leaves and promptly deciduous stipules. Flowers monoecious, apetalous, appearing with the leaves in the deciduous kinds. Staminate flowers in catkins; calyx parted into several lobes; stamens 4 to 12. Pistillate flowers 1 to 3 in an involucre of imbricated scales, the involucres borne in reduced or short catkins; ovary adherent to the calyx, 3-celled, 6-ovuled, only one ovule maturing, the remaining ovules and the other two cells abortive. Fruit a nut borne singly in a scaly cup, or 1 to 3 in a spiny bur.—Eight genera; Fagus (Beech) and Castanea (Chestnut) are represented in the eastern United States as well as in the Old World.

Bibliog.—Engelmann, Geo., Papers on American Oaks (Collected Works, p. 399,—1887). Greene, E. L., West American Oaks (1889). Sargent, C. S., Silva N. Am. vol. 8 (1895), vol. 9 (1896).

Fruit an acorn; catkins simple.
  Catkins unisexual, slender, the staminate drooping........................1. Quercus.
  Catkins erect, thick, all with staminate flowers, pistillate flowers at base of some of them. ....2. Pasania.
Fruit a spiny bur; catkins erect, often branching, the staminate long, the pistillate short. ....3. Castanopsis.

1. **QUERCUS** L. Oak.

Trees or shrubs of slow growth, hard wood and usually contorted branches. Flowers greenish or yellowish. Staminate catkins pendulous, one or several from the lowest axils of the season's shoot. Pistillate flowers borne in the upper axils of the season's shoot, the ovary with 3 to 5 styles or stigmas. Fruit an acorn, the nut set in a scaly cup. Abortive ovules often discernible in the ripe or nearly ripe acorn.—About 300 species distributed over the northern hemisphere. California has 14 species, 9 trees and 5 shrubs; it is for its area strong in species but very weak in individuals. Washington has 1 and Oregon 5 species, all of which occur in California. (Latin name of the oak.)

White Oaks.—Bark commonly white or whitish, wood light-colored; stamens mostly 6 to 9; stigmas sessile or nearly so; abortive ovules mostly towards base of nut.
Acorns maturing the first year; nut glabrous on the inner surface.
Deciduous species.
Branchlets pendulous; acorn cups deep, the nut long and slender; leaves pinnately parted with coarsely 2 to 3-toothed lobes; trunk bark dark brown, deeply cuboid checked; valleys ....1. *Q. lobata.*
Branchlets not pendulous; acorn cups shallow; trunk bark white, shallowly checked but smoothish.
Leaves dark lustrous green above, rusty or pale beneath, 5 to 7-parted; nut subglobose or oblong-cylindric.
Mossy trees; mainly North Coast Ranges............2. *Q. garryana.*
Shrub; montane .... *Var. breweri.*
Leaves bluish green above, pale beneath, oblong, coarsely toothed or entire; nut oval, often swollen at or below middle; dry foothills.3. *Q. douglasii.*
Evergreen species.
Small tree; leaves blue-green, oblong, mainly entire, nut subcylindric; southern California ....4. *Q. engelmannii.*
Shrubs; cups saucer-shaped.
Branches rigid; leaves ¾ to 1 inch long; chaparral areas.
Leaves brittle, plane, light green, oblong, spiny-dentate or entire; nuts oval to cylindric, blunt or pointed ....5. *Q. dumosa.*
Leaves tougher, dark green, convex above, regularly dentate; nuts short cylindric or subglobose, very obtuse................6. *Q. durata.*
Branches slender, pliable; leaves 3 to 4½ inches long, strongly parallel-nerved, toothed, chestnut-like; local in Siskiyous and vicinity.......... ....7. *Q. sadleriana.*
Acorns maturing the second year; nut tomentose or hairy within.
Trees; acorn cup usually very large and thick.
Leaves 2 to 3½ inches long, densely woolly when young, with prominent regular parallel nerves; islands off south coast..................8. *Q. tomentella.*
Leaves commonly 1 to 2 inches long, entire or spinose-toothed, dull green above, lead-color beneath or with a golden fuzz when young; cup typically like a yellow turban; mountains ....9. *Q. chrysolepis.*
Shrubs; acorn cup sub-turbinate or low bowl-shaped, thin; leaves ½ to 1½ inches long.
Branches slender and pliable, forming broom-like tufts at top of stems; leaves mostly entire, no golden fuzz; high montane.........10. *Q. vaccinifolia.*
Branches rigid, spreading; leaves dentate-prickly, olivaceous above, pale beneath; Southern and Lower California..................11. *Q. palmeri.*

Black Oaks.—Bark dark or black, wood dark or reddish; stamens mostly 4 to 6; stigmas on long styles; abortive ovules mostly towards top of nut; nut tomentose within.
Acorns maturing the first year, nut slender ovate; leaves roundish or elliptic, convex above; coast valleys and hills...............................12. *Q. agrifolia.*
Acorns maturing the second year.
Leaves oblong, obtuse or tapering to the acute apex, plane, pale yellowish below; nut slender ovate, often streaked longitudinally; interior valleys and hills..... ....13. *Q. wislizenii.*
Leaves pinnately parted, the divisions generally coarsely toothed, always bristle-tipped; nut oblong, obtuse; mountains.......................14. *Q. kelloggii.*

1. **Q. lobata** Neé. Valley Oak. (Figs. 62 and 63.) Graceful tree, com-

monly 40 to 75 but not rarely 100 to 125 feet tall, with a great crown which, in typical form, is broader than high, and whose spreading limbs finally end in long and slender pendulous branchlets reaching nearly or quite to the ground; trunk 2 to 8 or even 10 feet in diameter and 10 to 30 feet in height; bark on the main trunks 1 to $4\frac{1}{2}$ inches thick, dark brown or sometimes ashen gray, and checked nearly to the wood into plates 1 or 2 inches across, the plates on typical trunks cuboid but often rectangular or narrow; leaves 3 to 4 (rarely 6) inches long, 2 to 3 inches broad, green above, paler beneath with a thin but close covering of short hairs, yellow-veined, parted to the middle or nearly to the midrib into 3 to 5 pairs of lobes; lobes most commonly broadened towards the end, less frequently pointed, coarsely 2 or 3-toothed at apex or sometimes entire; staminate catkins 1 to 3 inches long; calyx-lobes 6 to 8, linear; stamens 8 to 11; pistillate flowers mostly solitary and sessile, producing acorns which mature in the first autumn; cup drab-brown, with a dull reddish tint, deeply hemispherical and very warty or tuberculate, $\frac{1}{2}$ to $\frac{3}{4}$ inch deep or more, and of greater diameter than the nut; nut long conical, at first bright green, later mahogany or chestnut-brown, $1\frac{1}{2}$ to $2\frac{1}{4}$ inches long, $\frac{1}{2}$ to $\frac{3}{4}$ inches in diameter.

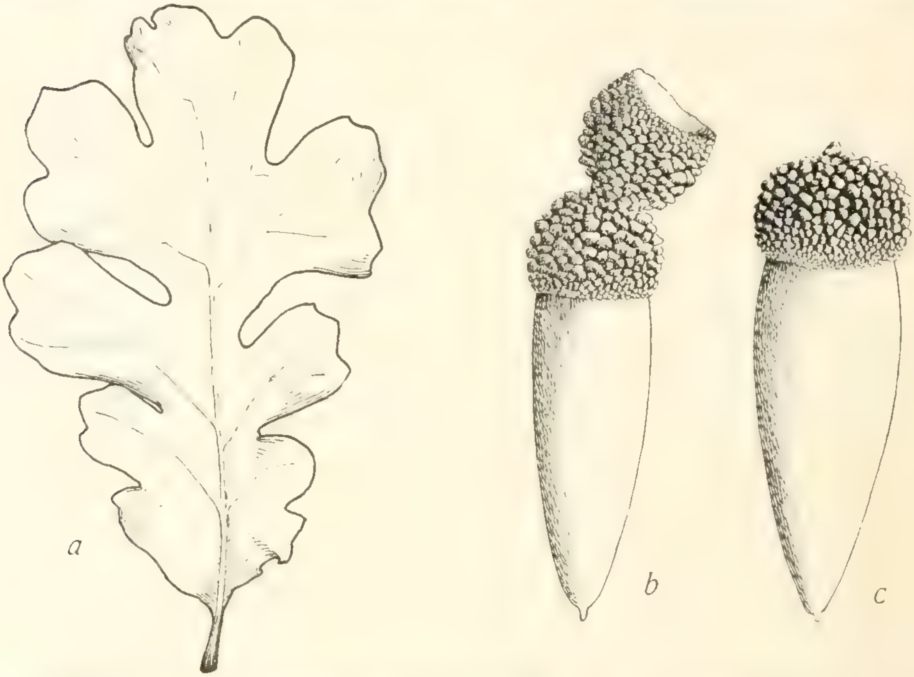

Fig. 62. Quercus lobata Neé. *a*, Typical leaf; *b*, *c*, acorns. nat. size.

Sacramento and San Joaquin valleys, and valleys of the Sierra Nevada foothills and Coast Ranges. Found as far north as Anderson and Shasta in Shasta Co., and Trinity River; as far south as Fort Tejon, and Ojai Valley, a few trees at San Fernando and Los Angeles. Characteristic of the richest valley loams where groves of scattered trees form park-like stretches of unequalled beauty. Sometimes occurring on low clay hills or in dry gravelly soil, especially in a less vigorous non-weeping form. Absent from valleys

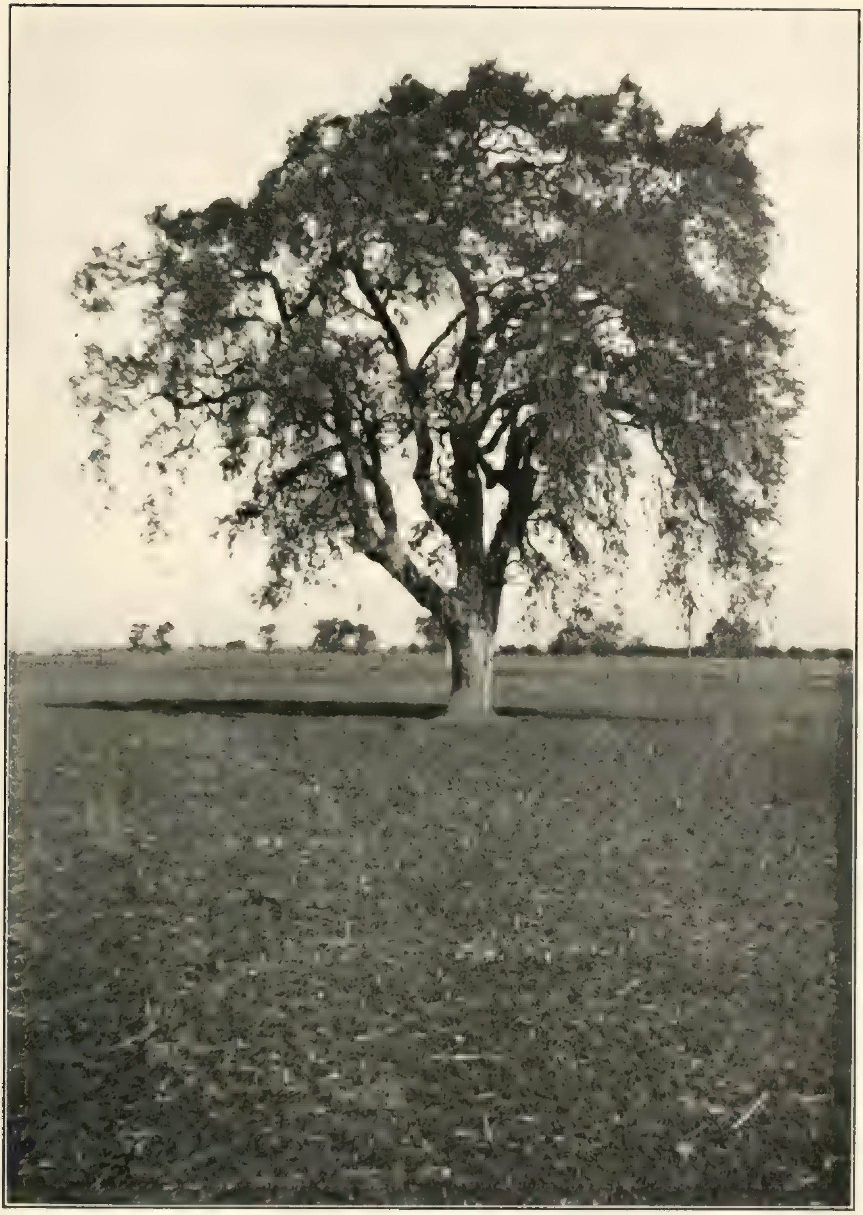

Fig. 63. Quercus lobata Neé. Tree with the characteristic weeping sprays. Usually scattered about singly on the valley floors, rarely crowding each other. (West side of the Sacramento Valley, one mile east of Vacaville.)

facing the sea. Wood hard but brittle and used only for fuel. Called also Burr Oak, Weeping Oak, Roble, White Oak, Mush Oak, Swamp Oak, Bottom Oak and Water Oak.

Forma **argillora** Jepson n. form. Tree mostly or quite destitute of pendulous branchlets; bark smoother, often whitish and simulating Blue Oak bark; leaves usually very deeply and narrowly lobed, often persistent through the winter.—(Arbor ramulis pendulis nullis vel paucis; cortex levior, albineus; folia pinnatifida, profundis lobis angustis, per hiemen sæpe persistantia).—Clay hills, as on the Araquipa Hills, Solano Co.

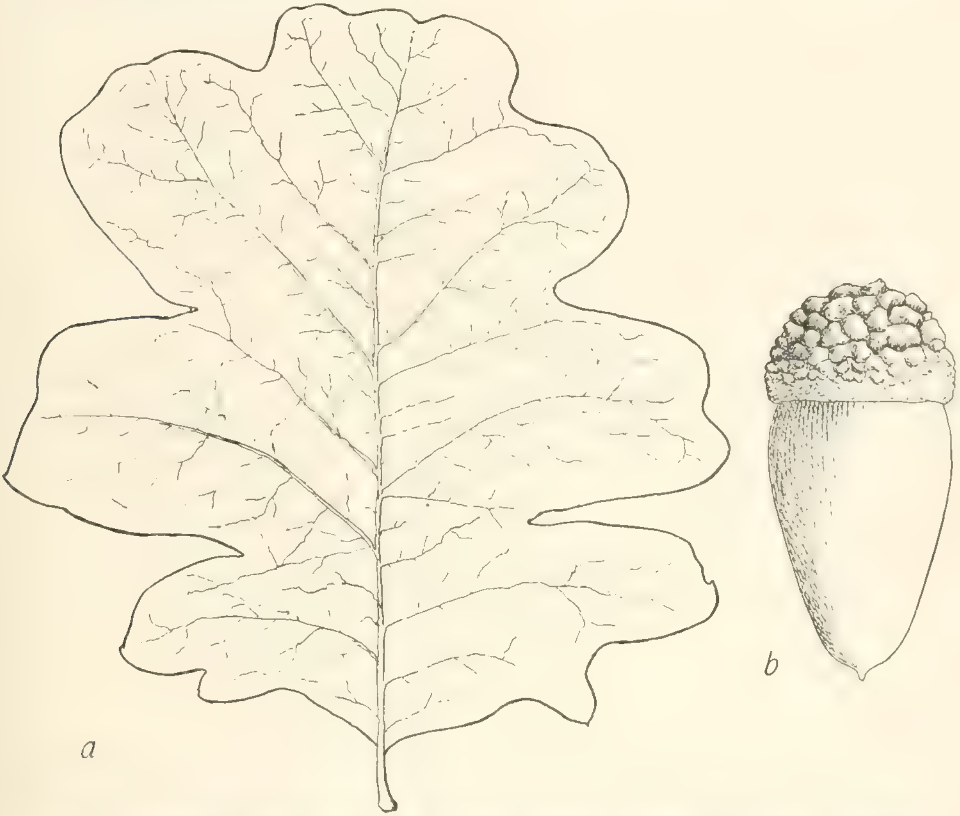

Fig. 64. Quercus lobata Neé var. walterii Jepson. *a*, Leaf; *b*, acorn. nat. size.

Forma **insperata** Jepson n. form. Leaves narrow, ¾ to 1¼ inches broad, 1½ to 2¼ inches long; cups strongly tuberculate, not so deep as in type; nuts rather smaller, 1¼ to 1⅝ inches long.—(Folia angusta, profunde pinnatifida, ¾ to 1¼ poll. lata, 1½ to 2¼ poll. longa; cupulæ tuberculatæ, minoris altitudinis quam in typo; glandes paulo minores, 1¼ ad 1⅝ poll. longæ).—Kaweah River basin, 3,500 feet, Walter Fry, Nov. 1908.

Forma **rarita** Jepson, n. form. Dwarfish or shrub-like; leaves smaller, deeply lobed (1½ to 2 inches long, ¾ to 1½ inches broad). (Pygmæa vel fruticosa; folia minora, profunde lobata, 1½ ad 2 poll. longa, ¾ ad 1½ poll. lata).—Near chaparral areas as on Twin Sisters Peak (W.L.J. no. 2384).

Var. **walterii** Jepson n. var. (Fig. 64.) Leaves 3 to 4 inches long, nearly as broad, sharply but mostly shallowly sinuate; cup large (1 inch broad) but shallow; nuts thick ovate, obtuse, 1½ inches long, 1 to 1⅛ inches thick.—(Folia 3 ad 4 lin. longa, paene eiusdem latitudinis, sinibus acutis sed plerumque brevibus; cupula magna, 1 poll. lata, sed brevis; glandes crassae ovatae obtusae, 1½ poll. longae, 1 ad 1⅛ poll. latae).—Kaweah River basin, 4,600 feet altitude, Walter Fry.

Var. **turbinata** Jepson n. var. Tall trees with larger, mostly deeply lobed leaves and more open sinuses than in the type; nuts inversely top-shaped and set in shallow cups with scales not so strongly tuberculate.—(Arbor magna alta; folia maiora plerumque profunde lobata, sinibus amplioribus quam in typo; glans turbinata inversa forma; cupula brevis squamis minoribus tuberculatis).—Little Lake Valley, W.L.J. nos. 2403, 2404.

Refs.—QUERCUS LOBATA Neé, An. Cienc. Nat. vol. 3, p. 277 (1801), type from the Monterey region; Greene, Erythea, vol. 2, p. 64 (1894); Shinn, Gard. & For. vol. 10, p. 52, fig. 8 (1897); Purdy, Gard. & For. vol. 10, p. 202, figs. 25, 26 (1897); Jepson, Erythea, vol. 7, p. 131 (1899), Fl. W. Mid. Cal. p. 142 (1901). *Q. hindsii* Bentham, Bot. Sulphur, p. 55 (1844), cited as from San Francisco where it does not grow; the label on type in the Kew Herbarium reads "San Francisco-Rio Sacramento," indicating clearly that it was collected on the lower Sacramento River expedition of the Sulphur by *Hinds;* Newberry, Pac. R. Rep. vol. 6, pt. 3, p. 29, pl. 1, fig. 7 (1857).

2. **Q. garryana** Dougl. OREGON OAK. Tree 25 to 55 feet high, the trunk 1½ to 5 feet in diameter and dividing into wide-spreading limbs which support a broad rounded crown 30 to 60 feet in diameter; trunk bark white, thin (½ inch thick), smoothish, but on typical trunks superficially fissured into longitudinal bands which are transversely checked into small squarish scales 1 inch or less in diameter; leaves 3 to 4 or 6 inches long, 1½ to 3½ inches broad, dark lustrous green and subglabrous on the upper surface, rusty or pale, finely pubescent and yellow-veined beneath, leathery in texture and parted into 5 to 7, or rarely 9, lobes with mostly deep and often acute sinuses; lobes entire or with 2 or 3 coarse rounded unequal teeth; staminate catkins hirsute; stamens 4 to 6; pistillate flowers sessile or short-pedunculate; acorns maturing in first autumn; cup saucer-shaped, 6 to 9 lines broad, with tuberculate scales; nut bulging beyond the small cup, typically subglobose but varying to obovoid or subcylindric, although always rounded at apex, ¾ to 1¼ inches long, ⅔ to 1 inch thick, its surface polished and shining.

Coast Ranges: Santa Cruz Mts.; Mt. Tamalpais, north slope; mountain slopes on both sides of Santa Rosa, Russian River and Ukiah valleys; abundant on all the higher mountains from Ridgewood, Willits, Sherwood, Cummings, Bell's Springs and Round Valley north to Siskiyou Co., mostly from 1,500 to 4,000 feet. Associated with Douglas Fir, Madroña and Black Oak (cf. Fig. 8); not in main Redwood Belt. Far north to Washington and British Columbia where it is the only oak. Wood used for shipbuilding and interior finish in Oregon. Also called Post Oak and Garry Oak.

Var. **semota** Jepson n. var. Leaves pinnatifid, the sinuses rather sharp, 3 to 4 inches long, 1¾ to 2¼ inches broad; cup shallow, scale tips thin, only slightly or somewhat tuberculate at base; nuts oval, 10 to 13 lines long.—(Folia pinnatifida sinibus subincisis, 3 ad 4 poll. longa, 1¾ ad 2¼ poll. lata; cupula brevis, apicibus squamarum tenuibus, basi subtuberculatis; glans ovalis, 10 ad 13 lin. longa).—Southern Sierra Nevada from the Kaweah Basin (type loc. 5,000 feet) northward to Mariposa. Scarcely different save in size and heretofore referred by authors to Q. breweri.

Var. **breweri** Jepson, n. comb. (Q. breweri Engelm.) BREWER OAK. Spreading shrub 4 to 18 feet high; leaves pinnately parted to middle, the lobes entire and acute, or broad and again lobed, finely pubescent or at length subglabrous, sometimes nearly felt-like below, often lustrous green above; cups shallow, 7 to 10 lines broad and 3 to 4 lines deep; the scales tuberculate; nuts oval, $\frac{3}{4}$ to 1$\frac{3}{8}$ inches long and $\frac{1}{2}$ to 1 inch broad.—High montane, Klamath Range (W.L.J. no. 2884), Marble Mt. (no. 2845), eastward to "six miles west of Mt. Shasta" (type loc. W. H. Brewer), south to the Trinity Mts. and perhaps the Yollo Bolly Range.

Refs.—QUERCUS GARRYANA Douglas in Hooker, Fl. Bor. Am. vol. 2, p. 159 (1853), type loc. Columbia River, *Douglas;* Jepson, Fl. W. Mid. Cal. p. 142 (1901). *Q. douglasii* Bentham, Pl. Hartw. p. 337 (1857), not of Hook. & Arn. teste specimen in Kew. Hb.(W.L.J.). *Q. oerstediana* Greene, West Am. Oaks, p. 19, pl. 10 (1889). *Q. oerstediana* R. Br. Campst, Ann. & Mag. Nat. Hist. ser. 4, vol. 7, p. 250 (1871) doubtless belongs here; the type was collected in Cañon Creek, Siskiyou Mts., 2,500 to 4,000 feet; described as "being always a shrub." *Q. breweri* Engelmann in Bot. Cal. vol. 2, p. 96 (1880).

3. **Q. douglasii** H. & A. BLUE OAK. Tree commonly 20 to 60 feet high, typically with a rounded crown; trunk $\frac{1}{2}$ to 2 (or sometimes 4) feet in diameter; bark white, shallowly checked into small thin plates, only slightly roughened but with the characteristic roughness extending up the limbs well onto the branches; leaves minutely pubescent, bluish green above, pale beneath, 1 to 3 inches long, $\frac{1}{2}$ to 2$\frac{1}{2}$ inches broad, mostly oblong to obovate, entire, or coarsely and often unequally few-toothed, or shallowly lobed; staminate catkins about 1 inch long; calyx yellow or green, with laciniately cleft segments and about 9 stamens; acorns ripe in first autumn; cup 4 to 6 lines broad, of less diameter than the nut and very shallow, the scales with small wart-like processes; nut $\frac{3}{4}$ to 1$\frac{1}{2}$ inches long, 6 to 10 lines in diameter, dark or light brown, oval in outline but variable, often much swollen just below or at the middle or only on one side, or again narrow and tapering to apex.

Dry or rocky foothills: Sierra Nevada between 500 and 2,500 feet; inner North Coast Ranges from the Vaca Mts. north to Redding and Trinity; Napa and Mt. Hood ranges north to Ukiah and Round Valley, but not in the high ranges from Willits north to the Siskiyous; inner South Coast Ranges from Mt. Diablo to Tehachapi, west to the San Antonio and Nacimiento river valleys (where very abundant) and south to the Sierra Liebre and San Fernando Valley (the southern outposts). Although constitutionally adapted to the arid foothills the stand is very open or scattered; it occurs by itself over long stretches of country or as an associate of the Digger Pine or Interior Live Oak. Also called Jack Oak, Post Oak, Rock Oak, Iron Oak, and Douglas Oak. Wood inferior, although some trees furnish good timber.

Refs.—QUERCUS DOUGLASII Hooker & Arnott, Bot. Beechey, p. 391 (1841), type loc. probably South Coast Ranges, first collected by Douglas; Hooker, Icon. vol. 4, t. 382, 383 (1841); Jepson, Fl. W. Mid. Cal. p. 142 (1901).

4. **Q. engelmannii** Greene. MESA OAK. Spreading tree 15 to 40 feet high, with trunk $\frac{1}{2}$ to 3 feet in diameter; leaves blue-green, oblong, obtuse, entire or sometimes toothed, $\frac{3}{4}$ to 3 inches long, but most commonly 1$\frac{1}{4}$ to 1$\frac{3}{4}$ inches long, $\frac{5}{8}$ to 1 inch wide; acorns 1 or 2 in a place, ripe in first autumn; cup $\frac{3}{4}$ inch broad, shallow or sometimes bowl-shaped, with warty scales, enclosing nearly $\frac{1}{2}$ the nut which is subcylindric, $\frac{1}{2}$ inch long and about as thick, or 1 inch long, relatively less thick and sometimes acute.

Low hills of San Diego Co., 15 or 20 miles from the sea (where it is abundant) to Oak Knoll (near Los Angeles) and San Gabriel. It ranges south into northern Lower California. The leaves persist until the appearance of the new leaves in the spring, whence the folk name "Evergreen White Oak."

Refs.—QUERCUS ENGELMANNII Greene, West. Am. Oaks, p. 33, pl. 15, figs. 2, 3, pl. 17; Abrams, Fl. Los Angeles, p. 105. *Q. oblongifolia* Engelmann in Bot. Cal. vol. 2, p. 96 in part.

5. **Q. dumosa** Nutt. SCRUB OAK. Shrub, 2 to 8 feet high, with tough rigid branches and branchlets; leaves typically oblong to elliptic or roundish, entire or more commonly coarsely and irregularly spinose or sinuate-lobed with sharply cut or angular sinuses, ¾ to 1 inch long; acorns ripe in first autumn, usually borne in clusters of 2 or 3; cup shallowly or deeply saucer-shaped, 5 to 8 lines broad, 2 to 5 lines deep, often rusty, the scales tuberculate, sometimes so regularly so as to suggest a quilted cushion; nut oval, cylindric, or somewhat conical, ¾ to 1⅛ inches long.

Montane shrub, an important member of the chaparral communities in Southern and Lower California, ranging northward through both the Coast Ranges and Sierra Nevada, more or less abundant in the middle and southerly parts of those ranges. Highly variable in leaf outline, texture and indentation of margin. Equally eccentric in shape and size of both nuts and cups. Stump sprouts from fire-killed shrubs also afford remarkable and interesting series in leaf variability (W.L.J. nos. 2699, 2700, 2701, coll. in San Carlos Range). Type collected at Santa Barbara by Thos. Nuttall.

Var. **turbinella** Jepson, n. comb. (Quercus turbinella Greene). GREY OAK. Small shrub; leaves pale on both surfaces, glabrous, finely reticulated below, oblong to broadly elliptic, rigid but brittle, spinosely dentate, ¾ to 1 inch long; cups gray, rather shallow, 5 to 7 lines in diameter, their scales closely woven, puberulent but not at all or scarcely tuberculate; nuts slender ovate, acute, 5 lines in diameter and about 1 inch long, the shell within quite glabrous.—Inner South Coast Range from the Rancho Cantua (S. C. Lillis) southward to Frazier Mt. (R. S. Baldwin); Campo, San Diego Co., and neighboring Lower California (type loc., G. W. Dunn).

Var. **alvordiana** Jepson, n. comb. (Quercus alvordiana Eastwood). BRITTLE-LEAF OAK. Leaves thickish, obscurely but seemingly densely tomentulose beneath, entire or irregularly and coarsely serrate, oblong, 10 to 15 lines long; cup 4 to 7 lines in diameter, 2 to 3 lines deep, turbinate-cupuliform, small for the thickness of the nut, its scales ovate, acute, flat or only slightly thickened towards the base; nut very long and narrow, 1⅝ inches long, ½ inch in diameter at widest part, tapering gradually to apex.—San Emigdio Cañon, Coast Ranges of Kern Co., Miss A. Eastwood, November 2, 1894, type. Diagnosis derived entirely from type specimen in the California Academy of Sciences. The same thing in excellent material sent by S. C. Lillis is found in the San Carlos Range 130 miles northerly. In that district it occurs at about 1,400 feet altitude, is confined to a red shale, and from a point on the headwaters of an easterly branch of Los Gatos Creek in section 20, township 19 south, range 15 east, it extends northwest along the red shale band of the Cantua region for about 18 miles until this formation dips into the San Carlos Range.

Refs.—QUERCUS DUMOSA Nuttall, Sylva, vol. 1, p. 7 (1842). *Q. turbinella* Greene, West. Am. Oaks, pp. 37 (1889), 59, t. 27 (1890). *Q. alvordiana* Eastwood, Cal. Acad. Sci. Occ. Pap. no. 9, p. 48, pl. 27, fig. 4 (1905).

6. **Q. durata** Jepson n. sp. LEATHER OAK. Low spreading shrub with rigid branches, 2 to 5 feet high; foliage and branchlets closely woolly when young,

at least minutely so in age; leaves oval, dentate with equal or nearly equal prickly teeth, the upper surface convex with more or less revolute margin, 1 to 1¾ inches long; cup 8 to 9 lines broad, 4 to 5 lines deep, the scales strongly tuberculate; nut short thick cylindric, obtuse, 7 to 9 lines long.—(Frutex humilis extendens, ramis rigidis, 2 ad 5 ped. alta; folia et ramula juniora dense tomentulenta; folia ovala, dentibus muricatis æqualibus, supra convexa, margine plus vel minus revoluto; cupula poculiforma, 8 ad 9 lin. in diametro, 4 ad 5 lin. in alto, squamis tuberculatis; glans cylindrica brevis crassa obtusa, 7 ad 9 lin. longa).

San Carlos Range, 2,500 to 5,000 feet, W.L.J. no. 2719, May, 1907; S. C. Lillis, Oct., 1908. Forms extensive pure thickets on the higher slopes and summits. Quercus dumosa, which is also abundant in the same region but chiefly at lower altitudes, has lost by the end of April all its old leaves and in early May bears only leaves of the new growth. Quercus durata, at that time, still retains its old leaves and shows no sign of new growth. Its leaves are so hardened that even on exposed slopes the foliage seems insensible to the extremes of both seasons; some leaves persist at least two years.

Refs.—QUERCUS DURATA Jepson. Probably Q. dumosa var. bullata Engelmann, Trans. St. Louis Acad. vol. 3, p. 393 (1877) as to New Idria and perhaps as to other types cited.

7. **Q. sadleriana** R. Br. Campst. DEER OAK. Bush, mostly 2 or 3 but even 8 feet high, with several slender stems from the base; leaves persistent through the winter and until after the new leaves appear in the next summer, oblong-ovate to broadly ovate, 3 to 4½ inches long, the lateral nerves regular and parallel, prominent on the under surface and ending in the teeth of the margin; stipules oblanceolate, ½ to ¾ inch long, fur-like on account of their dense covering of rusty hairs and persisting as long or even longer than the leaves; staminate catkins simple (rarely in clusters of 2 or 3 on a common peduncle), 1 to 2 inches long; calyx-border hairy and much cleft; stamens varying from 5 to 17, even on one bush; pistillate flowers solitary in the upper axils of the shoot; acorns maturing in first autumn; cup cup-shaped, thin; nut oval, about ¾ inch long.

High mountains from Trinity Summit, Humboldt Co. (W.L.J. no. 2033), to Coos Co., Oregon, forming extensive pure colonies on Marble Mt., Klamath Range and the Siskiyous. Shade tolerant and very common in the White Fir forests. Browse shrub, the foliage greedily favored by mules; acorns sweet and palatable, and eaten by deer and bear, whence the folk names Deer Oak and Bear Oak. Most restricted in range of any Californian oak.

Refs.—QUERCUS SADLERIANA R. Br. Campst., Ann. Mag. Nat. Hist. ser. 4, vol. 7, p. 249 (1871). Type loc. Crescent City trail between Sailors' Diggings in Oregon and Smith River in California, *Robert Brown*, Sept., 1865. First collected by John Jeffrey in southern Oregon, 1852-3 (teste spm. in Herb. Royal Botanic Garden, Edinburgh, *W. L. J.*).

8. **Q. tomentella** Engelm. ISLAND OAK. Round-headed tree 25 to 40 feet high; leaves elliptic to oblong, tomentose or glabrate and light green above in age, strongly parallel-nerved beneath, 2 to 3½ inches long; cup 1 to 1½ inches wide, ½ to ¾ inch deep, its scales imbedded in a dense tomentum but the tips free; nut subglobose, bluntish, 1 inch long.

Santa Cruz, Santa Rosa, Santa Catalina and San Clemente islands of the Santa Barbara group; Guadaloupe Island (type loc.). Strictly insular. Subspecies of the next.

Refs.—QUERCUS TOMENTELLA Engelmann, Trans. St. Louis Acad. vol. 3, p. 393 (1877), in Bot. Cal. vol. 2, p. 97 (1880); Sargent, Silva N. Am., vol. 8, p. 109, t. 402 (1895).

9. **Q. chrysolepis** Liebm. MAUL OAK. (Fig. 65.) Tree commonly 15 to 60 feet high or on exposed mountain summits reduced to a mere shrub a few feet high; trunk 1 to 5 feet in diameter, the whitish bark about ½ inch thick and fissured into narrow flat, more or less scaly ridges; leaves thick, green above, yellow beneath with a fine fuzz or powder, or eventually lead-color or dull white, ovate or oblong-ovate, acute at apex, entire, or with entire and toothed leaves frequently found on the same twig, commonly 1 to 2 but sometimes even 4 inches long; staminate catkins ½ to 2 inches long; calyx unequally lobed; stamens 8 to 10; pistillate flowers mostly sessile and solitary, or sometimes in short spikes; acorns maturing in second autumn; typical cup thick and round-edged with a fine fuzzy or felt-like tomentum concealing the scales, the whole suggesting a yellow turban, but thinnish cups and scanty pubescence not concealing the scales occur as frequently; nut ovate, globose, or cylindric, rounded at apex or sharply pointed, 1 to 1¼ inches long, ¾ to 1 inch broad.

Cañons, mountain slopes and plateaus: Sierra Nevada, most common between 1,500 and 5,000 feet, but round balls of Maul Oak shrubs grow on the talus and walls of the Yosemite, Tehipite, Kings, Kern and other cañons to an altitude of 5,000 to 9,000 feet; not on Mt. Shasta; Coast Ranges (in every mountain range of this region), attaining its finest development in Mendocino and Humboldt cos., where truly massive trees grow on shoulders of the mountain slopes or cañon bottoms; Southern California, on all the higher mountains; extends north to southern Oregon, south to Lower California and east to New Mexico. Has a greater geographical range and grows under greater variety of conditions than any other of our species of this family. Occurring in open stands and usually as much scattered trees. Extremely variable in size, appearance and foliage characteristics. Wood remarkable for its strength, toughness and close grain which makes it suitable for mauls, tool-handles and wagon parts. Woodsmen know it as Spanish Oak, Valparaiso Oak, Georgia Oak, Florida Oak, Iron Oak, Pin Oak, Hickory Oak, White Live Oak, Mountain Live Oak, Drooping Oak, Golden Oak, Cañon Oak and Laurel Oak. The numerous folk names are due to popular appreciation of its wood qualities but also in part to its variable form. The following are some of the extreme forms.

Forma **grandis** Jepson n. form. (Fig. 65d.) Tall tree with straight trunk and narrow crown 60 to 110 feet high; cups 6 to 8 lines broad and 4 lines deep, the scale-tips not involved in the dense close felt which is scantier than in the type; nuts oblong, 1 to 1⅛ inches long, obtusish or subacute.—(Arbor alta, trunco recto coma angusta 60 ad 110 ped. alta; cupulæ 6 ad 8 lin. latæ, 4 lin. altæ; apices squamarum non involuti, densa artaque coacta quæ est minor quam in typo; glandes oblongæ 1 ad 1⅛ poll. latæ, obtusiusculæ vel subacutæ).—Narrow North Coast Range cañons, fine examples in Mill Creek Cañon near Ukiah (W.L.J. no. 2416).

Forma **pendula** Jepson n. form. Broad-crowned tree with pendulous branchlets; leaves oblong-lanceolate to broadly lanceolate, 2 to 4 inches long, ½ to 1 inch broad, disposed to be entire, deep shining green above.—(Arbor coma lata ramulis pendulis; folia oblongo-lanceolata ad late lanceolata, 2 ad 4 poll. longa, ½ ad 1 poll. lata, plerumque integra, atrovirentia nitida supra).—Upper San Benito River (W.L.J. no. 2705, May, 1907). Similar and probably identical forms occur in El Dorado and Amador cos.

Forma **hansenii** Jepson n. form. (Fig. 65e.) Low tree; leaves ovate, acute, ¾ to 2½ inches long, the nerves below chiefly straight, regular and parallel; nut cylindric, about 10 lines long, 3 or 4 lines in diameter, set in a thick cup of greater diameter.—(Arbor parva; folia ovata acuta 1¾ ad 2½ poll. longa; nervi subtus plerumque recti, regulares parallelique; glans cylindrica circa 10 lin. longa, 3 vel 4 lin. in diametro, posita in crassa cupula maioris diametri). —Pine Grove, Amador Co., 2,300 feet, Geo. Hansen, 1905.

Forma **nana** Jepson n. form. (Fig. 65f.) Low compactly branched shrub; leaves oblong or ovate, acute, 1 to 1½ inches long; cup shallow, 7 or 8 lines broad; nut thick, ovate, blunt, ¾ to 1 inch long. (Frutex humilis dense ramosus; folia oblonga vel ovata, acuta, 1 ad 1½ poll. longa; cupula brevis 7 vel 8 lin. lata; glans crassa ovata obtusa, ¾ ad 1 poll. longa). —Mt. St. Helena summit, W.L.J.

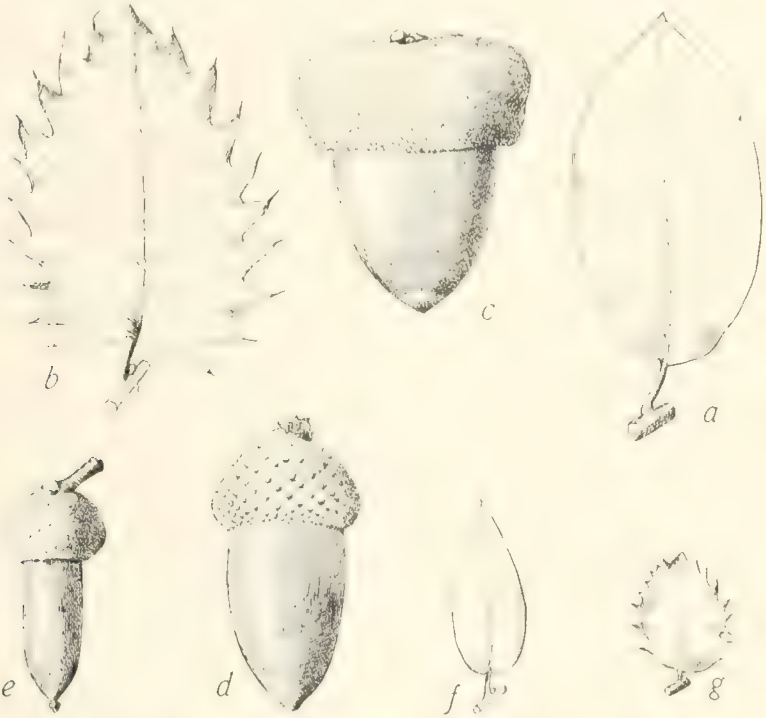

Fig. 65. Quercus chrysolepis Liebm. *a*, Entire leaf; *b*, toothed leaf; *g*, small toothed leaf typical of stump sprouts; *c*, acorn with turban-like cup. *d*, Forma grandis Jepson, acorn. *e*, Forma hansenii Jepson, acorn. *f*, Forma nana Jepson, leaf. nat. size.

Refs. Quercus chrysolepis Liebmann, Dansk. Vidensk. Selsk. Forhandl. 1854, p. 173, type from mountains near Carmel, *Hartweg*; Jepson, Fl. W. Mid. Cal. 143 (1901). *Q. oblongifolia* R. Br. Campst, Ann. & Mag. Nat. Hist. ser. 4, vol. 7, p. 252 (1871), not Engelmann, teste W.L.J. While none of Robert Brown's oak specimens were found by the writer either at Edinburgh or Kew herbaria, Brown ticketed a Jeffrey specimen of Q. chrysolepis at Edinburgh as "oblongifolia Torr."

10. **Q. vaccinifolia** Kell. Huckleberry Oak. Shrub, prostrate or erect and 2 to 6 feet high, the slender pliable branchlets in tufts at top of stems, simulating the habit of a huckleberry; leaves oblong-ovate, mostly obtusish

or only sub-acute, commonly entire, pale green above, often tan-color beneath, mostly ¾ to 1⅛ inches long or less; stamens 6 to 11; acorns small; cup broadly turbinate or shallowly bowl-shaped, thinnish, not fulvous-tomentose but merely pubescent, 3 to 4 lines broad; nut globose-ovate, rather abruptly drawn down to a sharp point, 4 to 6 lines long, 4 to 5 lines broad.

Sierra Nevada, exposed summits and slopes 6,000 to 9,000 feet; high North Coast Ranges from the Trinity Mts. northwesterly to the Klamath Range, Marble Mt. and the Siskiyous. Commonly forming extensive thickets and valuable as a protective cover against destructive runoff.

Refs.—QUERCUS VACCINIFOLIA Kellogg, Proc. Cal. Acad. vol. 1, p. 96 (1855); Merriam, Biol. Sur. Mt. Shasta, p. 142 (1899). *Q. chrysolepis* var. *vaccinifolia* Engelmann, Trans. St. Louis Acad. vol. 3, p. 393 (1877), in Bot. Cal. vol. 2, p. 97 (1880). Commonly regarded as a variety of the preceding species but well-enough defined geographically and taxonomically to be taken as a convenient subspecies.

11. **Q. palmeri** Engelm. PALMER OAK. Rigidly branched shrub 5 to 15 feet high; leaves roundish ovate to orbicular, wavy-spinose, undulate, coriaceous and stiff, olivaceous above, pale or whitish beneath, ½ to 1½ inches long, when young sparingly pubescent on the upper surface and with a dense but thin yellowish or later white felt on the lower surface; cup thinnish, subturbinate but shallow, rusty on outside, densely silky on inside, 5 to 7 lines broad, 3 to 5 lines deep; nut ovate, 1 inch long, the shell densely woolly within; cotyledons purple, separable.

San Jacinto Range (Vandeventers Ranch) to San Diego Co. (Larkens Station) and southward a short distance over the border of Lower California. A subspecies of Q. chrysolepis.

Refs.—QUERCUS PALMERI Engelmann, Trans. St. Louis Acad. vol. 3, p. 393 (1877); type loc. "mountains 80 miles east of San Diego," *Dr. Edw. Palmer;* Bot. Cal. vol. 2, p. 97 (1880). *Q. chrysolepis* var. *palmeri* Engelmann, Bot. Cal. l. c. as synonym.

12. **Q. agrifolia** Neé. COAST LIVE OAK. Low broad trees, usually 20 to 35 feet high, but even 60 or 70 feet high, the short trunk 1 to 4 feet in diameter, parting into erect limbs or more commonly into crooked widely spreading branches whose extremities often touch or even trail the ground; bark smooth and beech-like, or sometimes fissured, dark brown or gray on the surface, reddish or pink inside, very brittle when fresh, 1 to 2¼ inches thick; leaves roundish, elliptic, sometimes ovate or oblong, usually with spine-tipped teeth or entire, commonly 1 or 2 inches long but varying from ½ to 4 inches, usually convex above; staminate catkins 1 to 1½ inches long, deep red; stamens 4 to 8; pistillate flowers with acorns 1 in a place or in clusters of 2 to 5, maturing in the first autumn; cup broadly turbinate, 4 to 7 lines deep, embracing the base of the nut; nut usually slender ovate, 1 to 1½ inches long, 5 to 7 lines thick.

Valleys and hill slopes: North Coast Ranges from Cloverdale, Napa Valley and Suisun Valley (W.L.J. no. 3075) to Marin Co.; Oakland Hills and Mt. Diablo through all the South Coast Ranges to Lower California; in Southern California from the coast east to the San Jacinto Range at 4,000 feet. Abundant in the Santa Clara, Gilroy, Salinas and numerous other Coast Range valleys southward, often growing by itself and forming beautiful open groves on the valley floors. Wood used for fuel and the bark for tanning.

Refs.—QUERCUS AGRIFOLIA Neé, An. Cien. Nat. vol. 3, p. 271 (1801), type loc. Monterey; Greene, Erythea, vol. 2, p. 44 (1894); Jepson, Erythea, vol. 7, p. 131 (1899), Fl. W. Mid. Cal. p. 143 (1901).

13. **Q. wislizenii** DC. INTERIOR LIVE OAK. Round-headed tree most commonly 30 to 75 feet high; trunk 1 to 3 feet in diameter with a thick brittle bark which is very smooth or sometimes roughly fissured; leaves typically oblong (varying to elliptic, ovate or ovate-lanceolate), either tapering to apex or rounded, 1 to 2½ (or 4⅔) inches long, glabrous, green and shining above, pale yellowish green below, the margin entire or spiny-toothed; staminate catkins 2 to 3 inches long, sometimes borne in great profusion, 30 to 40 from a cluster of terminal buds; calyx-lobes 4 or 5, hairy pubescent; stamens 4 to 8; acorns ripe in second autumn, borne in clusters of 2 or 3 or singly; cup deeply cup-shaped to hemispherical, embracing ¼ to ½ the nut, 6 or 7 lines broad, its scales thin, red-brown; nut cylindric and tapering to the apex or conical, often longitudinally banded with dark lines converging at the summit, 1¼ to 1⅝ inches long.

Foothills and valleys from Shasta Co. and Lassen Peak, southward in the Sierra Nevada, Sacramento and San Joaquin valleys to Fort Tejon; North Coast Ranges from Twin Sisters Peak and the Vaca Mts. north along the inner range to Cottonwood Creek (Tehama Co.) and west to Ukiah Valley; also Kidder Creek, Siskiyou Co., acc. Geo. D. Butler. Attains its best development on the east side of the Great Valley where it is scattered singly or in small clusters along the fertile benches of the American, Mokelumne, Tuolumne and other rivers; the large dense crowns, as if like great globes resting on the ground with a segment cut off the lower side, evoke the admiring interest of the traveler.

Forma **extima** Jepson n. form. Acorns remarkably small but uniform; cup 3 or 4 lines deep; nut 8 or 9 lines long, 3 lines thick.—(Glandes parvae notabiliter sed constantes; cupula 3 ad 4 lin. in altitudine; glans 8 vel 9 lin. longa, 3 lin. in diametro).—Kaweah River basin, 4,000 feet altitude, Walter Fry.

Var. **frutescens** Engelm. Intricately and stiffly branched shrub 3 to 7 feet high with small leathery leaves.—High mountain summits of the Coast Ranges (1,000 to 4,000 feet): The Terraces near Ukiah (W.L.J. no. 2243), Elk Mt. and Mt. Konokti (Lake Co.), Vaca Mts., Mt. St. Helena, Mt. Tamalpais, Mt. Diablo, Mt. Hamilton and Santa Cruz Mts.; southward to the Sierra Madre, San Bernardino and San Jacinto ranges in Southern California at 5,000 to 7,000 feet altitude.

Refs.—QUERCUS WISLIZENII A. DeCandolle, Prodr. vol. 16, pt. 2, p. 67 (1867), type loc. American River, *Dr. F. A. Wislizenius*; Jepson, Fl. W. Mid. Cal. p. 144 (1901).

14. **Q. kelloggii** Newb. CALIFORNIA BLACK OAK. Graceful tree, commonly 30 to 85 feet high, with trunk 1 to 4½ feet in diameter and mostly erect or ascending main branches; bark black or dark, on old trunks deeply checked into small plates; leaves deeply and mostly sinuately parted with about 3 lobes on each side ending in 1 to 3 or more coarse bristle-tipped teeth, lustrous green above, lighter beneath, often white with a fine tomentum when young, 4 to 10 inches long and 2½ to 6 inches wide; staminate catkins 1½ to 3 inches long; calyx with 4 or 5 scarious lobes, stamens 5 to 9; pistillate flowers borne singly or 2 to 7 on a peduncle 3 to 8 lines long; acorns ripe in the second autumn (early in the second summer nuts completely covered by the cups, forming globose knobs about ½ inch in diameter); cup large, ¾ to 1 inch deep, ¾ to 1⅛ inches broad, covered with thin scales which have a membranous and sometimes ragged margin; nut typically oblong in outline, very

rounded at apex, 1 to $1\frac{1}{4}$ inches long and $\frac{3}{4}$ inch broad, covered at first with a fine fuzz and deeply set in a brown cup.

Valleys, mountain ridges and swales: Sierra Nevada, chiefly between 1,500 and 4,500 feet at the north and 3,500 to 6,500 feet at the south, either as scattered trees or in considerable groves near the lower limits of Yellow Pine; Coast Ranges, widely distributed both in the foothills and higher mountains, associated with Madroña, Blue Oak, Oregon Oak, Yellow Pine or Tan Oak, but not found in the Redwood Belt; Southern California, on all the higher ranges as far as the Cuyamaca Mts.; extends north to central Oregon. Extreme altitudinal range (in central California) 200 to 8,000 feet. Next to Maul Oak it is more widely distributed than any other oak in the State. It attains its best development in rich deep soil of ridge summits of central and eastern Mendocino and Humboldt cos., where truly splendid groves are found. Near Saratoga, Santa Clara Co., is a locally famous individual, almost perfectly symmetrical, 88 feet tall, the crown with a spread of about 90 feet, its branches sweeping nearly to the ground throughout its circumference; the trunk at 4 feet from the ground is 5 feet in diameter. Wood of Black Oak is pale red, fine-grained, brittle. Also called Kellogg Oak.

Refs.—QUERCUS KELLOGGII Newberry, Pac. R. Rep. vol. 6, pp. 28, 89, fig. 6 (1857). *Q. tinctoria* var. *californica* Torrey, Pac. R. Rep. vol. 4, pt. 5, p. 138 (1856). *Q. californica* Cooper, Smithsonian Rep. 1858, p. 261 (1859); Jepson, Fl. W. Mid. Cal. p. 144 (1901).

Q. MOREHUS Kellogg. Tree 25 to 50 feet high; leaves oblong to elliptic, $2\frac{1}{2}$ to 4 inches long, sinuately but rather shallowly lobed, the lobes pointing upward and spinose-tipped; cups similar to those of Q. wislizenii or more cup-shaped; nuts cylindric, about 1 inch long, 6 or 7 lines thick, minutely pubescent.—Occasional throughout the Sierra Nevada, 2,500 to 5,000 feet; Napa Range; Mayacamas Range; seaward Coast Range from Walker Valley to Mt. Tamalpais. Here considered as a hybrid between Q. kelloggii and Q. wislizenii. (Q. morehus Kellogg, Proc. Cal. Acad. vol. 2, p. 36,—1863; Greene, West Am. Oaks, pp. 3, 79, t. 2,—1889; Sudworth, Trees Pac. Slope, p. 311,—1908).

2. **PASANIA** Miq. TAN OAK.

Trees or shrubs with evergreen leaves and erect catkins. Staminate flowers one in a place, densely disposed in elongated simple erect catkins; stamens 8 to 10, four times as long as the 5-parted calyx. Pistillate flowers 1 in an involucre, the involucres few at the base of some of the staminate catkins; calyx often with rudimentary stamens; ovary 3-celled. Fruit an acorn, the cup with slender spreading scales.—Pasania (native name of one of the species in Java), a genus equally related to Quercus (the oaks) and Castanea (the chestnuts), is represented by one species in California and Oregon and by nearly one hundred in southern Asia and the Malay Archipelago. Both Quercus and Castanea are ancient types geologically and Pasania is of great interest as a connecting genus which has also survived to the present day.

1. **P. densiflora** Oerst. TAN OAK. Forest tree commonly 40 to 100 but even 150 feet high, the trunk 1 to 4 feet in diameter, clear of branches for 15 to 70 feet and running through to the summit of the cone-like crown; bark on young trunks white-mottled, on old trunks brown, red inside, smoothish on the surface or roughly checked into small plates; leaves oblong to elliptic-oblong, 2 to 5 inches long, 1 to 2 inches wide, densely whitish, tomentose when young, the lateral nerves parallel, very conspicuous on the under side and ending in

the teeth of the margin or the margin sometimes entire; catkins scattered singly in the axils of the leafy shoot of the season, or congested on several short subterminal leafless shoots and thus making a dense cluster of 25 or 50; catkins either wholly staminate or with a few pistillate flowers towards the base, erect, very tomentose, 3 to 5 inches long; staminate flowers consisting of about 10 stamens, 3 or 4 times as long as the woolly usually 5-lobed calyx; pistillate flower with an inferior ovary, 3 styles and a few rudimentary stamens; acorns maturing at the end of the second season; cup shallow or almost flat, $\frac{7}{8}$ to $1\frac{1}{8}$ inches in diameter, covered with narrowly linear or subulate spreading scales; nut oval, varying to subglobose or subcylindric, $\frac{3}{4}$ to $1\frac{1}{2}$ inches long, the shell densely tomentose within, at first finely tomentose without.

Outer North Coast Range, sea-level to 5,000 feet, associated with the Redwood but attaining its best development on the eastern margin of the Redwood Belt in Mendocino and Humboldt cos., ranging east to Cobb Mt. and the Napa Range and south to Marin Co., Santa Cruz, Santa Lucia and Santa Inez mts., as far south as the vicinity of Nordhoff. Lower Klamath River through Del Norte and western Siskiyou into Oregon as far as the Umpqua River. Sierra Nevada in scattered localities from Lassen Peak to Devil's Gulch, Mariposa Co. Highly valued for its bark which is used in large quantities by the California tanneries. After the tree is stripped of bark, about 90,000 trunks 10 to 110 feet long and $\frac{1}{2}$ to 4 feet in diameter are left to rot on the ground annually. Commercial utilization of the wood is a problem needing immediate solution.

Forma **lanceolata** Jepson n. form. Leaves lanceolate, entire or with few small teeth, $2\frac{1}{2}$ to $3\frac{1}{2}$ inches long.—(Arbor alta, folia lanceolata integra vel dentibus parvibus, $1\frac{3}{4}$ ad $3\frac{1}{2}$ poll. longa).—Central Mendocino, W.L.J. no. 2234; South Fork Smith River, no. 2887.

Var. **echinoides** Sargent. Scrub Tan Oak. Low or spreading shrub 1 to 10 feet high; leaves thick, entire, 1 to 2 inches long, $\frac{1}{3}$ to $\frac{7}{8}$ inch wide, the nerves often inconspicuous; acorns 1 to 4 in a place; cups very bur-like, the subulate or filiform scales recurving; nuts roundish, small, very shortly pointed. —About Mt. Shasta, westward to the Klamath Range and through the Siskiyous to southern Oregon; abundant in the Shelley Creek region of Del Norte Co. (W.L.J. no. 2910).

Refs.—PASANIA DENSIFLORA Oersted, Vidensk. Medd. For. Kjobenh. p. 83 (1866). *Quercus densiflora* Hooker & Arnott, Bot. Beechey, p. 391 (1841); Hooker, Icon. t. 380 (1841); Engelmann in Bot. Cal. vol. 2, p. 99 (1880); Jepson, Fl. W. Mid. Cal. p. 144 (1901). Var. ECHINOIDES Sargent, Silva N. Am. vol. 8, p. 183 (1895). *Q. echinoides* R. Br. Campst., Ann. & Mag. Nat. Hist. ser. 4, vol. 7, p. 251 (1871).

3. **CASTANOPSIS** Spach. CHINQUAPIN.

Trees or shrubs with evergreen leaves and branchlets lengthening by a terminal bud. Catkins slender, erect. Staminate flowers in clusters of 3, disposed on elongated, sometimes branching catkins; calyx 5 or 6-parted; stamens 6 to 12; ovary rudiment present. Pistillate flowers 1 to 3 in an involucre, the involucres on shorter catkins or sometimes scattered at the base of the staminate catkins; calyx 6-cleft with abortive stamens on its lobes; ovary 3-celled with 2 ovules in each cell; styles 3. Fruit maturing in the second season, the spiny involucre enclosing 1 to 3 nuts. Nuts ovoid or globose, more or less angled, usually 1-seeded.—Two species on the Pacific Coast of North

America and about 25 in southeastern Asia. (Greek kastanea, chestnut, and opsis, resemblance.)

1. **C. chrysophylla** A. DC. Giant Chinquapin. Singular forest tree 15 to 115 feet high, the unbranched shaft clear of branches for about one-half its height; branches short, forming a narrow crown rounded at summit or in age more or less broken; trunk 2 to 6 feet in diameter; bark fibrous, 3 inches thick, reddish in color but brown or dull gray on the surface and separated by deep furrows into heavy rounded ridges which are sparingly confluent; leaves oblong, tapering to base and also to the apex (often abruptly long-pointed), entire, dark green on the upper surface, at first golden with a fine tomentum below, later light olive-yellow, 2½ to 6 inches long, ¾ to 1¾ inches wide, nerves straightish, forking well inside the margin; catkins in more or less panicled clusters at the ends of the branches; staminate catkins simple or branching, 1 to 4 inches long, the flowers in clusters of 3 to 5, subtended by minute bracts; stamens 6 to 10, much surpassing the calyx; pistillate flowers 1 to 3 in an involucre, the involucres borne in shorter catkins or sometimes at the base of the staminate catkin; burs spiny, chestnut-like, irregularly 4-valved, containing 1 or sometimes 2 subtriangular nuts 4 or 5 lines long with hard shell and sweet kernel.

Ridges in the Redwood Belt of Mendocino and Humboldt cos. and far northward to the Coast Ranges and Cascades of Oregon and Washington. Attains its greatest size in central and southern Mendocino (Willits, W.L.J. no. 2412, Sherwood, no. 2195), where trees 70 to 115 feet high and 2 to 6 feet in diameter are scattered at rather long intervals through the forest.

Var. **minor** A. DC. Golden Chinquapin. Shrub 2 to 15 feet high; leaves 2 to 3 inches long, very golden beneath, often trough-shaped above; catkins profuse. Monterey (W.L.J. no. 2992), Santa Cruz Mts. (type loc.), Mt. Tamalpais, Mendocino White Plains and northward to the south fork of the Salmon River, passing into the species.

Refs.—CASTANOPSIS CHRYSOPHYLLA A. DeCandolle in Seeman's Jour. Bot. vol. 1, p. 182 (1863), Prodr. vol. 16, pt. 2, p. 109 (1864); Watson, Bot. Cal. vol. 2, p. 100 (1880) in part; Sargent, Silva N. Am. vol. 9, p. 3 (1896) in part. *Castanea chrysophylla* Douglas, in Hook. Fl. Bor. Am. vol. 2, p. 159 (1853), Comp. Bot. Mag. vol. 2, p. 127 (1836), type loc. Oregon Cascades near Grand Rapids of the Columbia River, *Douglas;* Jepson, Fl. W. Mid. Cal. p. 145 (1901) in part. Var. MINOR Bentham, Pl. Hartw. p. 337 (1857); DeCandolle sub Castanopsis chrysophylla, Prodr. vol. 16, pt. 2, p. 110 (1864).

2. **C. sempervirens** Dudley. Bush Chinquapin. Spreading shrub 1 to 8 feet high with smooth brown bark; leaves oblong, acutish at base, acute or obtuse at apex, or sometimes tapering upwards from near the base and therefore lanceolate-oblong, 1½ to 3 inches long and 5 to 11 lines broad; catkins simple, 5 to 20 in a rather dense terminal cluster, 1 to 1½ inches long, the upper with pistillate flowers at the base; stamens varying from 10 to 17, rarely as few as 8; styles 3, light brown, clavate.

High rocky or gravelly mountain summits or slopes: Sierra Nevada, chiefly between 3,000 and 6,000 feet; Coast Ranges, 1,500 to 4,000 feet, as on the Vaca Mts., Mt. St. Helena, Oakland Hills, Mt. Diablo and Santa Lucia Mts.; Southern California, abundant on Sierra Madre, San Bernardino and San Jacinto ranges, 8,500 to 10,000 feet.

Refs.—CASTANOPSIS SEMPERVIRENS Dudley in Merriam, Biol. Sur. Mt. Shasta, p. 142 (1899). *Castanea sempervirens* Kellogg, Proc. Cal. Acad. vol. 1, p. 71 (1855), type loc. vicinity of Mariposa, *Col. L. Ransom.* *C. chrysophylla* Jepson, Fl. W. Mid. Cal. p. 145 (1901) in great part.

JUGLANDACEAE. WALNUT FAMILY.

Deciduous trees with alternate pinnate leaves and no stipules. Stamens and pistils in different flowers on the same tree, both sorts without petals. Staminate flowers borne in lateral pendulous catkins on last season's wood. Pistillate flowers terminal on the new wood, 1 to several in a cluster. Ovary inferior; styles 2, stigmatic along the inside. Fruit an incompletely partitioned nut containing a single oily seed and covered by a green and fleshy or, when fully ripe, a dry brown or black husk.—Six genera, widely distributed. The genus Carya of the Eastern United States is well represented by the hickories, pignuts and pecans, some of which are cultivated in California.

1. JUGLANS L. WALNUT.

Bark strong-scented. Branchlets hollow, divided into little chambers by pithy partitions. Buds nearly naked. Staminate flower with an irregularly 3 to 6-lobed calyx and numerous stamens. Pistillate flower with a 4-lobed calyx adherent to the ovary. Seed so lobed as to fit the irregularities of the nut.—Ten species widely distributed. Four species in the United States, two in the east, a third, J. rupestris Engelm., occurs from Texas to Arizona. J. regia L., Persian or English Walnut, is extensively cultivated in California. (Name from Jovis and glans, the nut of Jove.)

1. **J. californica** Wats. CALIFORNIA WALNUT. Tree, or sometimes a small shrub, 10 to 50 feet high, the trunk with roughish nearly black bark; leaves pinnately compound, 6 to 13 inches long; leaflets 11 to 19, oblong-lanceolate, serrate, 1½ to 4 inches long; staminate catkins 2 to 4 inches long, each flower with 20 to 26 stamens; fruit globose, ¾ to 1¼ inches in diameter; nut hard, covered with a dry brown or in age black husk which does not separate from the shell or only in an irregular or partial manner, almost smooth, but marked with a few shallow longitudinal grooves.

Dry hillsides and valley washes: Santa Barbara National Forest, Ojai Valley to cañon south of Saugus, Newberry Park and Santa Monica, thence along the Sierra Madre and San Bernardino foothills as far east as San Bernardino and south to the Brea Cañon in the Sierra Santa Ana (southernmost locality). The trunk commonly branches near or at the ground and the individuals assume a shrub-like habit; even though they may grow to very considerable size the rounded shrub-like habit generally persists. Used with us as a stock graft for the horticultural propagation of the English Walnut.

Var. **hindsii** Jepson. Tree 40 to 75 feet high; trunk straight without branches up to 10 to 25 feet, 1 to 5 feet in diameter; leaflets mostly lanceolate and acuminate, occasionally oblong-lanceolate, 2 to 3 inches long, ½ to 1 inch wide; fruit 1¼ to 2 inches in diameter.—(Arbor 40 ad 75 ped. alta; truncus rectus sine ramis usque ad 10-25 ped., 1 ad 5 ped. in diametro; foliola plerumque lanceolata et acuminata, interdum oblongo-lanceolata, 2 ad 3 poll. longa, ½ ad 1 poll. lata; fructus 1¼ ad 2 poll. in diametro.)—Walnut Creek and Lafayette Creek, Contra Costa Co.; Lower Sacramento River near Walnut Grove; Napa Range, east slope near Wooden Valley. These northern trees were introduced by the native tribes in trading with the Indians of Southern California and are invariably found about ancient village sites.

Refs.—JUGLANS CALIFORNICA Watson, Proc. Am. Acad. vol. 10, p. 349 (1875); Watson, Bot. Cal. vol. 2, p. 93 (1880), as to California trees; Jepson, Fl. W. Mid. Cal. p. 146 (1901), Bull. S. Cal. Acad. vol. 7, p. 23 (1908). *J. rupestris* Torrey, Bot. Mex. Bound. p. 205 (1859), in part; Parish, Zoe, vol. 4, p. 345 (1894).

MYRICACEAE. Sweet-gale Family.

Shrubs or small trees. Leaves fragrant, alternate, simple, resinous-dotted, without stipules. Flowers in oblong or cylindrical catkins, unisexual, solitary and sessile in the axils of scaly bracts; perianth none. Staminate flower with 4 to 16 stamens, the bractlets usually 2; pistillate flower surrounded at base by 2 to 4 small scales or bractlets; ovary 1-celled, 1-ovuled; stigmas 2, filiform, sessile. Fruit a nutlet. Seed without endosperm.

1. MYRICA L. Wax Myrtle.

The only genus.—Mostly tropical, about 30 species. (Greek murike, the ancient name of the Tamarisk.)

Evergreen monœcious shrub; stamens 7 to 16, longer than the bracts; fruit waxy, berry-like. ....1. *M. californica.*

Deciduous diœcious shrub; stamens 3 or 4, shorter than bracts; fruit a minute glabrous nutlet ....2. *M. hartwegi.*

1. **M. californica** Cham. Wax Myrtle. Thickly branched evergreen shrub or small tree, 8 to 25 feet high; leaves thick, dark green, glossy, oblong, or oblanceolate-oblong, tapering above to an acute apex, narrowed below to a petiole, 2¾ to 5 inches long, remotely serrate or almost entire; flowers monœcious; pistillate catkins in the axils of the upper leaves, 3 to 5 lines long; staminate catkins below, sometimes as much as 1 inch long; androgynous catkins often occur between, with the staminate flowers at base; staminate flower consisting of 7 to 16 stamens, united by their filaments into a cluster longer than the bract; ovary ovate, stigmas bright-red, exserted; fruit globose, brownish purple, covered with a coat of whitish wax, 2 lines in diameter, the bractlets at the base minute.

Sand-dunes, moist hillsides, or rocky declivities near the ocean, from Santa Monica northward along the entire California coast and beyond our borders to Washington.

Refs.—Myrica californica Chamisso in Linnaea, vol. 6, p. 535 (1831), type loc. San Francisco, *Adelbert von Chamisso;* Jepson, Fl. W. Mid. Cal. p. 146 (1901).

2. **M. hartwegi** Wats. Sierra Bay. Deciduous shrub 4 to 6 feet high; leaves thin, oblong and tapering at base to a short petiole, acute at apex, serrate above the middle, 1¾ to 3½ inches long, ½ to 1 inch wide; staminate catkins 5 to 8 lines long; stamens 3 or 4, shorter than the bracts, their filaments united at base; pistillate catkins 2 lines or at length 3 to 6 lines long; nutlet less than 1 line long, smooth, glabrous, laterally subtended by 2 persistent bractlets which surpass it.

Sierra Nevada, about 5,000 feet: Big Creek near Mariposa Big Tree Grove; Rosasco's, Tuolumne Co.; northern Sierra Nevada, Theo. Hartweg, no. 1958, type (probably on Yuba River, not on the Sacramento River).

Refs.—Myrica hartwegi Watson, Proc. Am. Acad. vol. 10, p. 350 (1875), in Bot. Cal. vol. 2, p. 81 (1880).

URTICACEAE. Nettle Family.

Herbs with simple leaves. Flowers small (ours less than 1 line long), greenish, unisexual, clustered, the clusters disposed in catkin-like axillary spikes or loose axillary heads. Petals none. Staminate calyx with 4 distinct or nearly distinct sepals and as many opposite stamens, the filaments coiled or bent inward in the bud so that when released, they fly upwards like a spring, scattering the pollen. Pistillate calyx 2 to 4-toothed or -cleft, or of nearly distinct segments. Ovary superior, 1-celled, with 1 orthotropous erect ovule; style and stigma 1. Embryo straight. Endosperm oily. Fruit an achene, always enclosed or covered by the calyx.

Leaves opposite, toothed, stipulate; hairs stinging; achene flattened.
  Pistillate calyx 4-parted, the segments almost distinct, the inner ones largest..1. URTICA.
  Pistillate calyx saccate, 2 to 4-toothed at orifice..................2. HESPEROCNIDE.
Leaves alternate, entire, without stipules; hairs not stinging; achene ovoid; pistillate calyx tubular, 4-cleft..3. PARIETARIA.

1. **URTICA** L. NETTLE.

Annual or perennial herbs with stinging hairs. Leaves opposite, petioled, 3 to 7-nerved, with stipules. Flowers in ours monœcious, clustered, the clusters in axillary, often branching spikes. Staminate flower with 4 sepals, 4 stamens and a cup-shaped rudiment of a pistil. Pistillate calyx with the sepals unequal, the exterior smaller than the inner and at length enclosing the flattened achene; ovary with sessile tufted or almost feathery stigma. Endosperm scanty. (Latin name of the nettle.)

Pistillate and staminate flowers in separate spike-like inflorescences; perennial.
  Herbage gray; leaves ovate to lanceolate..........................1. *U. gracilis* var.
  Herbage dark green; leaves broadly ovate, cordate at base............2. *U. californica.*
Pistillate and staminate flowers mixed in the same cluster; herbage dark green; annual.
  ....3. *U. urens.*

1. **U. gracilis** Ait. var. **holosericea** Jepson n. comb. (U. holosericea Nuttall). Stem erect, unbranched, 4 to 10 feet high; leaves long ovate to lanceolate, commonly green and with scattered bristles above, gray below with a short dense pubescence, coarsely serrate, 3 to 5 inches long; petioles ½ to 2 inches long; stipules narrowly oblong, mostly acutish, 2 to 6 lines long; flowers (as also in next) sessile in small clusters (glomerules), the clusters in dense simple or somewhat paniculately branched spikes; pistillate spikes ½ to 2 inches long, the staminate in axils below the pistillate and often twice as long; inner sepals not or scarcely exceeding achene; achene elliptic but acutish at apex and often at base, smooth.

Along creeks, about damp spots in the hills, in moist valleys or in marshes, common and often abundant; throughout California except in the desert regions; extends north to Washington. Ranges altitudinally from sea-level to 9,800 feet in the Sierra Nevada. From the ordinary Eastern U. gracilis the Californian plant differs only in its more abundant (albeit variable) pubescence and somewhat more densely flowered spikes, being more like it than the plant of the southern Rocky Mts. (U. gracilenta Greene). In pubescence and in amount of flower production var. holosericea is very variable. It has the following forms:

Forma **greeneii** Jepson n. form. Herbage yellowish green; achene with very short and obscure stipe.—(Herba flavo-viridis; achenium stipiti breve).—Etna, Siskiyou Co., E. L. Greene, no. 1028.

Forma **densa** Jepson n. form. Herbage very gray; leaves on flowering portion of stem reduced, the paniculate spikes equalling or exceeding them, very numerous and forming a dense uninterrupted compound panicle.—(Herba cana valde; inflorescentia paniculata duplicata densa).—Howell Mt., W.L.J., Sept. 24, 1893; also lower Sacramento River (Andrus Island).

Refs.—URTICA GRACILIS Aiton, Hort. Kew. vol. 3, p. 341 (1789). *U. holosericea* Nuttall, Jour. Phil. Acad. n. s. vol. 1, p. 183 (1847), type loc. near Monterey, *Gambel;* Jepson, Fl. W. Mid. Cal. p. 147 (1901).

U. BREWERI Watson, Proc. Am. Acad. vol. 10, p. 348 (1875), type loc. Los Angeles, *Brewer,* no. 95 (1861). Leaves thin, finely hispid beneath, tuberculately roughened above; panicles scarcely exceeding petioles; sepals twice longer than the broadly ovate achene.—A dubious species; origin of the type open to doubt since not found near Los Angeles by later collectors, although diligently searched for (cf. S. B. Parish in Zoe, vol. 5, p. 113,—1901). Pringle's no. 2005 (1888), State of Chihuahua, determined as this species by Watson, has a broadly ovate (in some cases almost obcordate) pappillate roughened achene as long as the inner sepals.

2. **U. californica** Greene. COAST NETTLE. Stem often branched from the base, 2 to 3 feet high, producing stolons; stems and petioles hispid and somewhat pubescent; leaves broadly ovate, deeply cordate, coarsely serrate, subglabrous above, shortly pubescent below and often gray, 3 to 4 inches long and nearly as broad, or the lower 4 to 7 inches long; petioles 1 to 3 inches long; stipules oblong to elliptical, obtuse, 3 to 6 lines long; spikes simple or paniculately branched, mostly exceeding petioles; inner sepals equalling ovatish achene.

Low lands near the coast from Lake Pilarcitos (San Mateo Co.) northward to Tennessee Bay and Tomales Bay (Marin Co.); Yes Bay, Alaska; probably Washington.

Refs.—URTICA CALIFORNICA Greene, Pitt. vol. 1, p. 281 (1889), type loc. Pt. Pietras, San Mateo Co., *Greene*, 1887. *U. lyallii* var. *californica* Jepson, Fl. W. Mid. Cal. p. 147 (1901). U. lyallii Watson, a taller more slender plant of Washington and British Columbia, has narrower thinner leaves with entire caudate apices, at base truncate or barely cordate.

3. **U. urens** L. SMALL NETTLE. Erect and simple or branching from the base, 1 to 1½ feet high, leafy to the top, very sparingly hispid; leaves elliptic or ovate, coarsely laciniate-serrate, 3 to 5-nerved, ½ to 1½ inches long, slender petioled; stipules short, about 1 line long; flowers more or less pedicelled in glomerules, the glomerules in an oblong rather dense spike often shorter than the petioles; fruiting calyx with hispid-ciliate margins.

Native of Europe, now widely naturalized in central and Southern California.

Locs.—San Diego; Ramona, *T. S. Brandegee*, 1894; Riverside; Pasadena; San Buenaventura, *Brewer*, 1861; Santa Cruz Island, *Greene*, 1886; Santa Barbara, *Dunn*, 1891; Ft. Tejon Springs; Greenfield (Kern Co.); Pacific Grove, *W.L.J.* 1896; Evergreen, San Jose, Santa Clara, Mayfield, acc. *Davy*, 1902; San Francisco; Berkeley.

Refs.—URTICA URENS Linnaeus, Sp. Pl. p. 984 (1753); Parish, Zoe, vol. 1, p. 125 (1890); Jepson, Fl. W. Mid. Cal. p. 147 (1901).

2. HESPEROCNIDE Torr.

Annual herbs similar to Urtica. Stipules minute. Staminate calyx with 4 almost distinct sepals. Pistillate calyx consisting of a membranous flattened oblong-ovate sac with a minutely 2 to 4-toothed orifice. (Greek hespera, west or western, and knide, a nettle.)

1. **H. tenella** Torr. Slender, erect or straggling, 1 or 2 feet high; stems and petioles bristly with scattered hairs, the blades very sparsely hispid; leaves thin, ovate, serrately incised, ½ to 1½ (or 2) inches long on slender petioles; flowers densely glomerate in the axils, the clusters shorter than the petioles; pistillate calyx thin, hispid with hooked hairs, in fruit ½ to less than 1 line long; achene with minutely roughened surface.

Coast Ranges from Napa Valley southward to Southern California.

Locs.—Pinole Cañon, *Greene;* Bushy Knob, *Brewer*, no. 1194; Santa Clara foothills, *C. F. Baker*, no. 667; Santa Monica Mts., *Braunton*, no. 1274; San Bernardino, *Parry & Lemmon;* San Diego; San Clemente Island, acc. *Davidson*.

Refs.—HESPEROCNIDE TENELLA Torrey, Pac. R. Rep. vol. 4, p. 139 (1857), type loc. Napa Valley, *Dr. J. M. Bigelow* (1854); Jepson, Fl. W. Mid. Cal. p. 148 (1901).

3. PARIETARIA L. PELLITORY.

Ours low unarmed annuals with alternate entire 3-nerved leaves without

Jepson, Fl. Cal. pp. 337-368, Nov. 4, 1909.

stipules. Flowers perfect and pistillate in axillary clusters, involucrate by small leafy bracts. Staminate calyx 4-parted. Pistillate calyx tubular-ventricose, 4-lobed. Achene ovoid, enclosed by the persistent calyx.—All continents, 7 species. (The ancient Latin name of the Italian species because growing on walls.)

1. **P. debilis** Forst. Stems very slender, several from the base, diffuse, 4 to 10 inches long; herbage pilose or hispid; leaves ovate to ovate-lanceolate, rounded at base or abruptly cuneate, often shortly attenuate to the obtuse apex, 3 to 12 lines long, or the lowest very small, on petioles 1 to 3 lines long; clusters few-flowered.

Moist shady places: Southern California and north to Inyo Co. North and South America, Asia, Australia.

Locs.—San Diego; Witch Creek, *Alderson;* Palm Cañon, *Jepson* 1365, *Hall* 1882; Menifee, *Alice King;* San Bernardino, *Parish;* Arrowhead Sprs., *Setchell;* San Gabriel Mts., acc. *McClatchie;* Redondo, *Braunton* 345; Santa Cruz Island, *Brandegee;* Santa Barbara, acc. *Yates.*

Ref.—PARIETARIA DEBILIS Forst. Prodr. 73 (1786), type loc. New Zealand.

PLATANACEAE. PLANE FAMILY.

Large deciduous trees with alternate ample palmately lobed leaves and sheathing stipules; dilated base of petiole enclosing the bud of the next season; bark falling away in thin plates. Flowers monoecious, the staminate and the pistillate on separate axes, closely packed in separate ball-like clusters distributed at intervals along a terminal very slender axis, the inflorescence thus appearing moniliform. Receptacles very hairy and individual flowers difficult to segregate. Calyx and corolla none. Stamens with long anthers and very short filaments densely crowded on a globose fleshy receptacle. Pistils with interspersed clavate truncate bracts, crowded on a similar receptacle; ovary 1-ovuled; style one, filiform, laterally stigmatic. Fruit a coriaceous nutlet with tawny hairs about the base.

Bibliog.—Griggs, R. F., Characters and Relationships of the Platanaceae (Bull. Torr. Club, 36: 389-395,—1909).

1. PLATANUS L. PLANE TREE.

The only genus.—Northern hemisphere, 5 species. (Greek platus, broad, referring to the ample leaves.)

1. **P. racemosa** Nutt. WESTERN SYCAMORE. (Fig. 66.) Tree 40 to 90 feet high with a massive crown of wide-spreading limbs; leaves 3½ to 9 (or 13) inches long, commonly broader than long, parted into 3 to 5 broad, spreading fingers or lobes; margin entire or with few small teeth; stipules very conspicuous when full grown, roundish or angular in outline and encircling or sheathing the stem; ball-like flower clusters, 2 to 7 in number, distributed at intervals along a pendulous and very slender axis borne at or near the end of a branch; balls falling to pieces in the winter, releasing the seed-like nutlets.

Common and sometimes abundant in river-bottoms. Sacramento Valley southward through the Sierra Nevada foothills, the San Joaquin Valley and South Coast Ranges to the coast region of Southern California. Lower California. Individual trees frequently attain great size. The trunks are often remarkable for their great divergence from the perpendicular, due to the shifting character of the soil in stream beds. Not known in North Coast Ranges. Northernmost station at Anderson, Tehama Co.

Refs.—PLATANUS RACEMOSA Nutt. Sylva, 1: 47, t. 15 (1842); Jepson, Fl. W. Mid. Cal. 275 (1901), Silva Cal. 247 (1910).

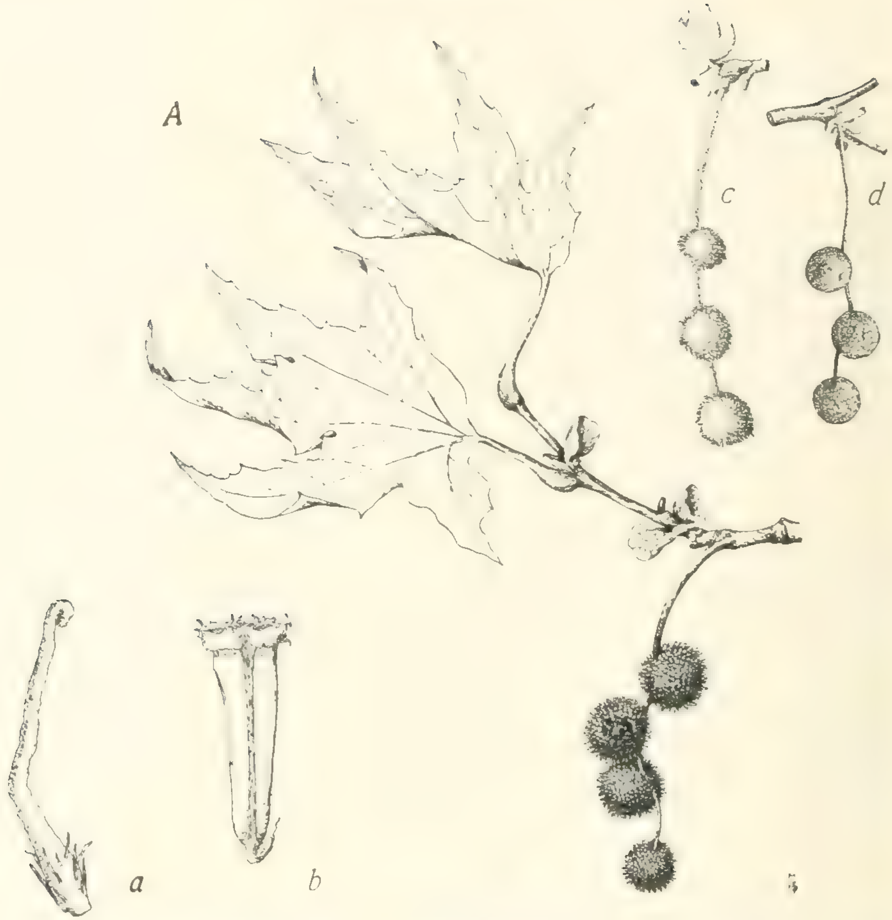

Fig. 66. Platanus racemosa Nutt. *A*, fruiting branchlet, x $\frac{1}{3}$; *a*, pistil, x 12; *b*, stamen, x 12; *c*, staminate inflorescence, x 1; *d*, pistillate inflorescence, x 1.

LORANTHACEAE. Mistletoe Family.

Evergreen plants, parasitic on trees. Branches dichotomous. Leaves opposite, simple and entire, or often reduced to connate scales. Flowers dioecious (in ours), greenish and inconspicuous, regular, apetalous. Calyx 2 to 5-lobed. Stamens as many as the calyx-lobes and inserted upon them; anthers 1 or 2-celled. Ovary inferior, 1-celled. Fruit a berry with glutinous endocarp. Embryo straight, in copious endosperm.—All continents, mostly tropical, 21 genera and 550 species.

Bibliog.—Engelmann, Geo., Papers on Loranthaceae (Collected Works, 488-495,—1887). Cannon, W. A., Anatomy of Phoradendron villosum (Bull. Torr. Club, 28: 374-390,—1901); Observations on the Germination of Phoradendron villosum and P. californicum (l. c. 31: 435-443,—1904). York, H. H., Anatomy and Biological Aspects of Phoradendron flavescens (Univ. Tex. Bull. 120,—1909). Bray, W. L., The Mistletoe Pest in the Southwest (Bur. Pl. Ind. Bull. 166,—1910). Blumer, J. C., Mistletoe in the Southwest (Pl. World, 10: 240-246,—1910). Meinecke, E. P., Parasitism of Phoradendron juniperinum libocedri (Proc. Soc. Am. For. 7: 35-41,—1912).

Berry sessile; flowers globose; leaves foliaceous or scale-like................1. PHORADENDRON.
Berry on a recurved pedicel; flowers mostly compressed; leaves scale-like and connate.......
2. ARCEUTHOBIUM.

1. PHORADENDRON Nutt. MISTLETOE.

Parasitic on mostly deciduous trees, the stems much branched and swollen at the nodes. Leaves foliaceous and coriaceous, or scale-like. Flowers sunk in the joints of the jointed spikes, usually several to each scale. Staminate calyx commonly 3-lobed, the anthers 2-celled, sessile on the base of the lobes. Pistillate calyx adherent to the ovary, the 3 teeth persistent on the globose semitransparent mucilaginous sessile berry.—North and South America, mostly tropical, 80 species. (Greek phor, a thief, and dendron, a tree.)

Leaves foliaceous; spikes many-flowered; anthers transverse, opening by pores.
    Leaves elliptic to oblong, 3 or 5-nerved.
        Herbage yellowish ....1. *P. flavescens.*
        Herbage greenish ....2. *P. villosum.*
    Leaves narrowly oblong or spatulate, nerveless........................3. *P. bolleanum.*
Leaves reduced to short scales; spikes few-flowered.
    Anthers oblong, opening by longitudinal slits.........................4. *P. californicum.*
    Anthers transverse, opening by pores..................................5. *P. juniperinum.*

1. **P. flavescens** Nutt. var. **macrophyllum** Engelm. YELLOW MISTLETOE. Foliage yellowish green; leaves orbicular to ovate or narrowly elliptic, obtuse, 3½ inches long or less, conspicuously 5-nerved from the base and distinctly petioled; fruiting spikes dense, 1½ inches long or less; berries white, 2 lines in diameter.

Sacramento and San Joaquin valleys to Southern California and east to Texas. Parasitic on various soft-wood trees: on Aesculus californica (the haustoria spread in the bark and by buds give rise to a twiggy growth); on Populus fremonti (the trees are frequently killed by the parasite); also occurs on various willows. Stems 1 to 5 feet long, forming a large woody shrub.

Refs.—PHORADENDRON FLAVESCENS Nutt. Jour. Acad. Phila. ser. 2, 1: 185 (1848) by implication, the type spm. from Texas. Var. MACROPHYLLUM Engelm. Bot. Wheeler, 252 (1878), type spms. from the Gila and Bonita rivers.

2. **P. villosum** Nutt. COMMON MISTLETOE. Foliage deep green; leaves elliptic, obtuse, 3-nerved, ½ to 1 inch long, on short petioles; berries pinkish, 1½ lines in diameter.

Coast Range and Sierra Nevada foothills; Southern California. Arizona to Oregon. Parasitic chiefly on oaks, observed on the following species: Quercus douglasii, lobata, wislizenii, kelloggii, and chrysolepis, and Umbellularia californica. Stems woody, forming shrubs 1 to 6 feet in diameter.

Refs.—PHORADENDRON VILLOSUM Nutt. Jour. Acad. Phila. ser. 2, 1: 185 (1848) by implication; Engelm. in Gray, Jour. Bost. Soc. Nat. Hist. 6: 212 (1850), type loc. Willamette woods, Ore.

3. **P. bolleanum** Eichler. Stems ½ to ¾ foot long, thickly branched; leaves narrowly oblong or spatulate, obtuse, contracted to a short petiole, ½ to 1 inch long; bracts ciliolate; spikes short, mostly less than ¼ inch long, opposite or in 4s; berries pearl-like on account of their whiteness, translucency and luster, rather less than 2 lines in diameter.

Coast Ranges and Sierra Nevada, through the Mohave Desert to Southern California. South into Mexico.

Locs.—Hornbrook, Siskiyou Co., *Copeland* 3542, on Juniperus; Middletown, *Jepson*, on Cupressus macnabiana; Mt. Tamalpais, *Eastwood*, on Cupressus sargentii; Santa Monica, *Barber* 205; Leonis Valley, *Davy* 2603, on Juniperus. Common in the tops of Abies concolor between Yosemite and Mariposa Big Trees, often finally killing the terminal part (four to six feet) of the axis.

Refs.—PHORADENDRON BOLLEANUM Eichler, in Mart. Fl. Bras. 5^2: 134m (1868); Jepson, Fl. W. Mid. Cal. 366 (1901). *Viscum bolleanum* Seem. Bot. Herald, 295, t. 63 (1856), type loc. Sierra Madre, Mexico.

4. **P. californicum** Nutt. Stems slender, terete, hanging or pendulous from the host; herbage pubescent or finally glabrous; scales broadly ovate, acute, spreading; staminate spikes consisting of 2 or 3 (or 5) flower-bearing joints, each with 2 to 6 flowers; anthers oblong, the cells opening by a longitudinal slit; pistillate spikes sometimes with nearly as many joints and flowers as the staminate; joints in fruit elongated (2 to 12 lines long); berries red, 2 lines in diameter.

Southern California along the Colorado River and in the Colorado Desert. Arizona. Parasitic on Prosopis juliflora and pubescens, Larrea mexicana, Acacia greggii, etc.

Locs.—Imperial, *Roadhouse*; Indio, *Davy* 45; Mecca, *Mary McKibben*; Cottonwood Sprs., *Hall* 6014; Mellen, Colorado River, *Jepson* 5195.

Ref.—PHORADENDRON CALIFORNICUM Nutt. Jour. Acad. Phila. ser. 2, 1: 185 (1848), type loc. Southern California, *Gambel*, parasitic on Prosopis pubescens.

5. **P. juniperinum** Engelm. Stems stout, terete, in erect tufts, 6 to 12 inches high, the ultimate branchlets 4-sided; scales low-triangular, ciliate, distinct or connate; staminate spikes consisting of 1 (rarely 2) very short joints; joints 6 to 8-flowered; anthers tranverse, opening by pores; pistillate spikes 2-flowered; berry whitish or light red, 1½ lines in diameter.

Sierra Nevada, on Juniperus. East to New Mexico.

Var. **libocedri** Engelm. Branches longer and more slender; joints more elongated.—Sierra Nevada south to the San Bernardino and San Jacinto mountains, on Libocedrus decurrens.

Refs.—PHORADENDRON JUNIPERINUM Engelm. Mem. Am. Acad. ser. 2, 4: 58 (1849), type loc. Santa Fe. Var. LIBOCEDRI Engelm. Bot. Cal. 2: 105 (1880), type Californian.

2. ARCEUTHOBIUM Marsch-Bieb. PINE MISTLETOE.

Plants yellow or brown, leafless, fragile-jointed, parasitic on coniferous trees. Stems quadrangular or angled. Leaves reduced to connate scales. Flowers solitary or several in each axil, crowded into apparent spikes, opening in autumn. Staminate flower:—calyx mostly 3-parted, compressed; stamens 3, the anthers sessile near the center of the calyx-lobes, roundish, 1-celled, opening by a circular slit. Pistillate flower:—calyx 2-cleft, the teeth laterally disposed, the ovary ripening the next autumn after flowering and exserted on the recurved pedicel. Berry circumscissile near the base, when fully ripe explosively dehiscent at a touch or when teased, the glutinous seed being expelled to a distance of several feet.—Northern hemisphere, 10 species. (Greek arkeuthos, juniper, and bios, life.)

Staminate flowers on peduncle-like joints in a paniculate cluster.........1. *A. americanum.*
Staminate flowers in the axils of the scales of a simple or compound spike.
    Host plant Pseudotsuga..2. *A. douglasii.*
    Host-plant Pinus species.
        Staminate plants yellow, pistillate ones brown................3. *A. campylopodum.*
        Staminate and pistillate plants of the same color or nearly.
            Branches erect; staminate flowers many...................4. *A. cryptopodum.*
            Branches divaricate; staminate flowers often few...........5. *A. divaricatum.*

1. **A. americanum** Nutt. Plants greenish yellow, dichotomously or verticillately much branched; staminate flowers nearly all terminal on distinct peduncle-like joints.

Sierra Nevada from the Yosemite region northward to British Columbia and east to the Rocky Mts. On Pinus murrayana.

Locs.—N. Fork Kings River, *Hall & Chandler* 426; Little Yosemite Valley, *Bolander* 5095.

Refs.—ARCEUTHOBIUM AMERICANUM Nutt.; Engelm. in Gray, Jour. Bost. Soc. Nat. Hist. 6: 214 (1850), type from Oregon, *Nuttall*. *Razoumofskya americana* Kuntze, Rev. Gen. Pl. 2: 587 (1891).

2. **A. douglasii** Engelm. Small, the stems suberect, ¼ to 1 inch high; flowers in short usually 5-flowered spikes; berry 2½ lines long.

Northern Sierra Nevada and north to Idaho; east to New Mexico. On Pseudotsuga taxifolia.

Locs.—Sierra Valley acc. Bot. Cal. 2: 106; Mt. Shasta, *Hall & Babcock* 4078.

Var. **abietinum** Engelm. Larger, the stems 1 to 5 inches long.—Bear Valley, Nevada Co., on Abies concolor; northward to Washington.

Refs.—ARCEUTHOBIUM DOUGLASII Engelm. Bot. Wheeler, 253 (1878), type spms. from the Southwest. *Razoumofskya douglasii* Kuntze, Rev. Gen. Pl. 2: 587 (1891). Var. ABIETINUM Engelm. in Bot. Cal. 2: 106 (1880), type loc. Sierra Valley, *Lemmon*.

3. **A. campylopodum** Engelm. Stems dichotomously branched, 4 to 15 inches long, the branches bearing numerous spikes, the lower spikes commonly with accessory spikes in the axils; staminate plants deep yellow, their spikes dense, ½ to ¾ inch long; pistillate plants olive-brown, their spikes ¼ to 1 inch long, paniculate; berries brown, oblong-elliptic, 2 to 2½ lines long.

Southern California; Coast Ranges and Sierra Nevada. North to British Columbia. On Pinus.

Locs.—Hamburg, Siskiyou Co., *Butler* 1070, on Pinus ponderosa; Russian Creek, Siskiyou Co., *Butler* 273, on P. tuberculata; Sisson, *Jepson*, on P. ponderosa; Elk Mt., Lake Co., *Tracy* 2355, on P. ponderosa; Samuel's Sprs., Napa Co., *Jepson*, on P. sabiniana; Mt. St. Helena, *Jepson*, on P. tuberculata; Conn Valley, Napa Range, *Jepson*, on P. ponderosa; Mt. Diablo, *Jepson*, on P. sabiniana; Mt. Hamilton, *Chandler* 6022, on P. sabiniana; San Bernardino Mts., *Parish*, on P. coulteri; Mt. San Jacinto, *Hall* 2566, on P. lambertiana, 2616, on P. ponderosa; Bower Cave, *Jepson*, on P. ponderosa; Snow Creek, Yosemite, *Hall*, on P. jeffreyi.

Refs.—ARCEUTHOBIUM CAMPYLOPODUM Engelm. Jour. Bost. Soc. Nat. Hist. 6: 214 (1850), type loc. vicinity northern Idaho, *Geyer*. *A. occidentale* Engelm. in Bot. Cal. 2: 107 (1880). *Razoumofskya occidentale* Kuntze, Rev. Gen. Pl. 2: 587 (1891); Jepson, Fl. W. Mid. Cal. 366 (1901).

4. **A. cryptopodum** Engelm. Stout, 2 to 4 inches high, brownish yellow or olive-brown; staminate plants smaller than the pistillate; staminate spikes with buds flattened against the spikes; anthers attached above the middle of the lobes.

Colorado and New Mexico to Arizona. Mineral King and Soda Sprs., southern Sierra Nevada, acc. *Coville* (Contrib. U. S. Nat. Herb. 4: 192). On Pinus ponderosa.

Refs.—ARCEUTHOBIUM CRYPTOPODUM Engelm. in Gray, Jour. Bost. Soc. Nat. Hist. 6: 214 (1850), type loc. Sante Fe, *Fendler* 283. *A. robustum* Engelm. Bot. Wheeler, 254 (1878).

5. **A. divaricatum** Engelm. Stout, 2 to 4 inches high, branches divaricately spreading, often flexuous or recurved; staminate flowers few and scattered; pistillate spikes often with sterile ones behind them in the same axils; berry 1½ to 1¾ lines long.

Providence Mts., *Brandegee*. East to Utah and New Mexico. On Pinus monophylla.

Ref.—ARCEUTHOBIUM DIVARICATUM Engelm. in Bot. Wheeler, 253 (1878), type spms. from the Southwest.

SANTALACEAE. Sandalwood Family.

Herbs or shrubs, usually root parasites. Leaves simple, entire. Flowers small, in ours perfect, mostly greenish. Corolla none. Calyx valvate, 4 or 5-cleft, the lower part of the tube adherent to the ovary. Stamens 3 to 6, inserted opposite the calyx lobes and between the lobes of the disk. Ovary 1-celled; style one; stigma capitate; ovules 2 to 4, suspended from the top of a free central placenta. Fruit indehiscent, nut-like, 1-seeded. Seeds without testa. Embryo small, axile at one end of the abundant endosperm.—Tropical or a few in the temperate zones, 26 genera and 250 species.

1. COMANDRA Nutt. Bastard Toad-flax.

Perennial herbs with rootstocks, striate stems and glabrous herbage. Leaves alternate, nearly sessile, the lowest scale-like. Flowers greenish white, in small terminal or axillary cymose clusters. Calyx campanulate or urnshaped, 5-cleft. Anthers borne on filaments and also attached to calyx-lobes by a tuft of thread-like hairs. Placenta filiform, contorted. Fruit nut-like, crowned by the persistent calyx-lobes, the cavity filled by a globular seed.—North America and Europe, 5 species. (Greek kome, hair, and ander, man, referring to the hairy appendages of the stamens.)

1. **C. umbellata** Nutt. Stems many from a somewhat woody base, 5 to 12 inches high; leaves green or pallid, oblong, acute at base and apex, $\frac{1}{2}$ to 1 inch long, shortly petioled; flowers $2\frac{1}{2}$ lines long; fruit globose, the size of a pea, the persistent calyx-lobes forming a sort of neck.

Sierra Nevada, commonly between 5000 and 6000 feet. North to British Columbia and east to the Atlantic. July-Aug. Parasitic on the roots of shrubs.

Locs.—Mineral King, *Hall & Babcock* 5694; Old Colony Mill, Sequoia Park, *Jepson* 633 (flowers occasionally 6-merous); Alta Peak, *Hopping* 80; Merced Big Trees, *Jepson;* Pine Ridge, Fresno Co., *Hall & Chandler* 73; Clinton, Amador Co., *Hansen* 540; Jackson, Amador Co., *Hansen;* Goose Valley, Shasta Co., *Baker & Nutting;* Goosenest Mt., *Butler* 1069; Spring Camp, Shasta Co., *Misses Jones & Alexander;* Sisson, *Setchell & Dobie.* Narrow-leaved non-glaucous specimens which seem intermediate between C. umbellata and C. pallida are as follows: S. Fork Kaweah River, *Culbertson* 4479; Alta Mdws., *Grant* 1309; Yosemite Trail, *Brewer* 1629; Siskiyou Co., *Bradley.*

Refs.—COMANDRA UMBELLATA Nutt. Gen. 1: 157 (1818). *Thesium umbellatum* L. Sp. Pl. 208 (1753), type spms. from Va. and Penn.

C. PALLIDA A. DC. Prodr. 14: 636 (1857), type loc. Clearwater, Idaho, *Spalding.* Herbage paler or glaucous; leaves linear-lanceolate; fruit ovoid.—Ore., Wash. and eastward. Coville cites it as occurring at Mineral King (Contrib. U. S. Nat. Herb. 4: 194), but we are unable to refer definitely any Californian specimen to this species since our material of Comandra does not seem to separate into two consistent units.

ARISTOLOCHIACEAE. BIRTHWORT FAMILY.

Perennial herbs or twining shrubs. Leaves simple, alternate, petioled, cordate. Flowers perfect, apetalous, with a petal-like synsepalous 3-lobed calyx. Stamens 6 to 12 with extrorse anthers. Styles 6 or 1. Ovary inferior, 6-celled. Fruit a fleshy or dry capsule. Seeds in 1 or 2 rows on the inner angle of each cell, with a minute embryo in copious endosperm. –Five genera and about 200 species, tropic and warm temperate regions of all continents.

Calyx regular, persistent; capsule irregularly dehiscent........................1. ASARUM.
Calyx irregular, deciduous; capsule septicidally dehiscent..................2. ARISTOLOCHIA.

1. ASARUM L.

Nearly acaulescent herbs with fragrant slender creeping rootstocks bearing 2 or 3 scale-like bracts, then 1 or 2 reniform or cordate leaves on long closely approximate petioles and a short-peduncled flower close to the ground in the axil of the lower leaf. Calyx regular, campanulate, the limb 3-parted, the lobes spreading or recurved. Stamens 12, nearly free from the styles, at first reflexed, the alternate ones shorter; filaments more or less distinct, the connective usually continued beyond the anther into a point. Styles 6, more or less united. Capsule globose, fleshy, commonly bursting irregularly. Seeds large, thick, 2 rows in each cell.—North temperate zone, 15 species. (Derivation obscure.)

Rootstock stolon-like, remotely scaly; styles united, equaling the stamens.
    Calyx-lobes 1 inch long or more ....1. *A. caudatum.*
    Calyx-lobes 4 to 6 lines long..2. *A. lemmoni.*
Rootstock rather closely scaly; styles nearly distinct..........................3. *A. hartwegi.*

1. **A. caudatum** Lindl. WILD GINGER. Evergreen herb; leaves cordate-reniform, shortly acute or obtusish, pubescent below and above on the veins, 2 to 6 inches broad, on petioles 3 to 7 inches long; peduncles 6 to 12 lines long; calyx-lobes triangular or oblong, attenuate into a tail which is 1 to $2\frac{1}{4}$ inches

long; filaments stout, the free apex of the connective much shorter than the anther; styles united, equaling the stamens.

Deep shade of Coast Range woods, in California following rather closely the Redwood Belt from the Santa Cruz Mts. northward. Extends north to British Columbia.

Locs.—Coffee Creek, Salmon Mts., *Hall* 8532; Trinity Summit, *Goddard* 117; Eureka, *Tracy* 794; Sherwood Valley, *Davy & Blasdale* 5168; Mendocino City, *Bolander* 4785; Stewart's Pt., *M. S. Baker;* Howell Mt., *Jepson;* Olema, *Jepson;* Moraga Valley, *Davy;* San Leandro Creek, *Chandler* 869; Pescadero Creek, San Mateo Co., *Copeland;* Santa Cruz, *Eastwood.* Probably occurs in the Redwoods of the Santa Lucia Mts.

Refs.—ASARUM CAUDATUM Lindl. Bot. Reg. sub. t. 1399 (1831), type loc. Fort Vancouver, Wash., *Douglas;* Jepson, Fl. W. Mid. Cal. 363 (1901).

2. **A. lemmoni** Wats. Leaves thin, rounded at summit; flowers mostly glabrous; calyx-lobes only 4 to 6 lines long, obtuse or acute; connective only slightly produced beyond the anther.

Northern Sierra Nevada; Plumas and Sierra cos.

Locs.—Brush Creek, Butte Co., *Kate Conger;* Downieville, *Eva Kennedy* 20; Placer Co., *Hardy;* Merced Grove, *Hall & Babcock* 3413; Alta Mdws., *Hopping* 513; Fortman Mt., Mariposa Co., *Congdon.*

Refs.—ASARUM LEMMONI Wats. Proc. Am. Acad. 14: 294 (1879), the type spms. from Plumas Co., *R. M. Austin,* and Sierra Co., *Lemmon.*

3. **A. hartwegi** Wats. Rootstock rather closely scaly; leaves 2 to 5 inches broad, strikingly mottled, pubescent below, glabrous above or sometimes pubescent along the lateral veins; flowers on pedicels ½ inch long; calyx long, hairy outside, the tube 6 to 8 lines long, the lanceolate attenuate lobes twice as long; connective as long or twice as long as anther.

Sierra Nevada, 4000 to 7000 feet; also in Trinity Co. North to the Cascade Mts., Oregon.

Locs.—N. Fork Middle Tule River, *Hall* 8354; Marble Fork Kaweah River, *Hopping* 301; Cedar Creek, Sequoia Park, *Jepson* 617; Merced River, *Hall* 8850; Bower Cave, *Congdon;* Clinton, Amador Co., *Hansen;* Camino, El Dorado Co., *K. Brandegee;* Burney Valley, Shasta Co., *Baker & Nutting;* Trinity Divide, Shasta Co., *Blasdale;* Sisson, *Jepson;* Shasta Sprs., *Heller* 7989; Russian Creek, Siskiyou Co., *Butler* 143; Hupa Valley, *Davy* 5734; New River, Trinity Co., *Jepson* 1986.

Ref.—ASARUM HARTWEGI Wats. Proc. Am. Acad. 10: 346 (1875), type loc. middle Sierra Nevada.

2. ARISTOLOCHIA L. PIPE VINE.

Twining shrubs with sparingly branched stems and axillary pendulous flowers. Calyx tubular, strongly curved and pipe-shaped. Anthers 6, rarely 7 or 8, sessile, disposed in pairs and adnate to the short simple style. Stigma 3 to 6-lobed or -angled. Capsule 6-angled and 6-valved, septicidally dehiscent. Seeds horizontal, in one row in each cell, numerous.—About 180 species, tropic and temperate regions. (Greek aristos, best, locheia, parturition, from its supposed efficacy in child-birth.)

1. **A. californica** Torr. DUTCHMAN'S PIPE. Deciduous woody climber, twining 5 to 12 feet high on shrubs, the herbage more or less pubescent, sometimes silky; leaves ovate, cordate, 1½ to 3 (or 5½) inches long, on petioles 1 or 2 inches long or less; pedicels ¾ inch long, with a bract at the middle; calyx greenish, veined with purple, 1⅛ to 1½ inches long; inside of tube near the base with a broad dull purple band; limb 2-lipped, the upper of 2 broad obtuse lobes, the lower entire, all lined with a disk-like thickening which on the upper side is continued downward and at the angle forms a projection partially closing the tube; ovary clavate; stigma with 3 broad obtuse lobes; capsule broadly oblong-obovate, abruptly contracted to a slender base, 6-winged, 2 to 2½ inches long; seeds cuneate-obovate, 3 lines long, deeply concave on the upper side, the edges incurved, with a very prominent spongy raphe in the concavity.

Coast Range hills from Monterey Co. and Contra Costa Co. to Shasta Co., thence southward in the Sierra Nevada foothills to Sacramento Co. Most frequent in the North Coast Ranges from the Vaca Mts. to Sonoma Co. Mar.-Apr.

Locs.—Little Sur River acc. *F. G. Woodcock;* Santa Cruz Co. acc. *Anderson;* Port Costa, *Chandler* 866, *Hall* 1682; Ross Valley, *Chesnut & Drew;* Bear Valley, Marin Co., *Alice King;* Howell Mt., Napa Co., *Tracy* 1561; St. Helena, *Jepson* 507; Araquipa Hills, Solano Co., *Jepson;* Sonoma, *Bioletti;* Healdsburg, *Alice King;* Cazadero; Glen Ellen; Marysville Buttes, *Jepson;* Fair Oaks, Sacramento Co., *M. S. Baker;* Butte Creek, Butte Co., *R. M. Austin* 151; Redding, *Heller* 7882.

Refs.—ARISTOLOCHIA CALIFORNICA Torr. Pac. R. Rep. 4^5: 128 (1857), type loc. Corte Madera, Marin Co., *Bigelow;* Jepson, Fl. W. Mid. Cal. 364 (1901).

SAURURACEAE. LIZARD-TAIL FAMILY.

Ours perennial astringent herbs, with nodose scape-like stems and alternate entire petioled leaves. Flowers perfect, bracteate, in a dense terminal spike. Perianth none. Stamens in ours 5 to 8. Ovary 1-celled, with 1 to 5 stigmas. Fruit a capsule or berry.—North America and Asia, 3 genera and 4 species.

1. ANEMOPSIS Hook.

Stoloniferous herb with aromatic rootstock and astringent somewhat spicy herbage. Leaves mostly radical. Spike conical, surrounded at base by a persistent showy involucre of 5 to 8 bracts; each flower (except the lowest) also subtended by a small white bract. Ovary sunk in the rachis of the spike; stigmas 2 or 3. Capsule dehiscent at the apex.—One species. (Greek anemone, and opsis, appearance, since the flowers resemble those of Anemone.)

1. **A. californica** Hook. YERBA MANSA. Stems hollow, ½ to 2 feet high, with a broadly ovate or elliptic clasping leaf above the middle and a fascicle of 1 to 3 small petioled leaves in the axil; radical leaves elliptic-oblong, rounded above, often somewhat narrowed toward the cordate base, 2 to 8 inches long, on petioles 1 to 8 inches long; spikes ½ to 1½ inches long; involucral bracts white (or reddish beneath), oblong, ½ to 1¼ inches long; floral bracts obovate, clawed, 2½ to 3 lines long; ovules 6 to 10 on each placenta.

Common in saline and rather wet lowlands: lower Sacramento Valley south through the San Joaquin and South Coast Ranges to Southern California and north through the Mohave Desert to Inyo Co. East to Utah and w. Texas and south into Mexico. An infusion of the root is used by Spanish-Californians both as a liniment for skin troubles and as a tea for disorders of the blood.

Refs.—ANEMOPSIS CALIFORNICA Hook. Ann. Nat. Hist. 1: 136 (1838); Hook. & Arn. Bot. Beech. 390, t. 92 (1841); Hook. Bot. Mag. t. 5292 (1862); Cov. Contrib. U. S. Nat. Herb. 4: 192 (1893); Blochman, Erythea, 2: 39 (1894); Jepson, Fl. W. Mid. Cal. 162 (1901). *Anemia californica* Nutt. Ann. Nat. Hist. 1: 136 (1838), type loc. Santa Barbara and San Diego.

POLYGONACEAE. BUCKWHEAT FAMILY.

Ours herbs or low bushes with simple leaves. Flowers small, regular, mostly perfect, without corolla, and rarely solitary. Calyx 5 to 6-cleft or -parted. Stamens 4 to 9, more or less attached to the calyx. Ovary superior, 1-celled, 1-ovuled and bearing 2 or 3 styles or stigmas. Fruit an achene, mostly triangular in ours, sometimes lenticular.—About 32 genera and 700 species, found in all lands of the earth.

Bibliog.—Bentham, Geo., On the Eriogoneae (Trans. Linn. Soc. 17: 401-420,—1837). Torrey & Gray, Rev. Eriogoneae (Proc. Am. Acad. 8: 145-200,—1870). Watson, S., Eriogonum, Chorizanthe (Proc. Am. Acad. 12: 254-273,—1877). Parry, C. C., Chorizanthe (Proc. Davenp. Acad. Sci. 4: 45-63,—1884; 5: 174-176,—1889); Lastarriaea (l. c. 5: 35-36,—1886); Notes of Eriogoneae (Bot. Gaz. 11: 54,—1886). Small, J. K., Monog. N. Am. Species of Polygonum (Mem. Columbia Coll. Dept. Bot. 1: 1-183,—1895); Studies in N. Am. Polygonaceae (Bull. Torr. Club, 25: 40-53,—1898; 33: 51-57,—1906). Greene, E. L., New Species of Eriogonum (Pitt. 5: 67-71,—1902); New Species of Polygonum (l. c. 197-203,—1903); Certain Polygonaceous Genera (Leaflets, 1: 17-50,—1904). Jones, M. E., [Notes on] Eriogonum (Contrib. 11: 4-18,—1903).

Leaves alternate or basal, always with sheathing stipules; involucre none.

Sepals 5, equal and erect in fruit; stigmas capitate....................1. POLYGONUM.

Sepals unequal, the inner row erect and enlarging in fruit, the outer row reflexed; stigmas tufted.

Leaves not reniform; sepals 6....................2. RUMEX.

Leaves reniform; sepals 4....................3. OXYRIA.

Leaves opposite or basal, without sheathing stipules.

Flower or flowers subtended by one or several distinct bracts, or none.

Bract enlarged in fruit, 1-flowered, 2-lobed, 2-saccate on the back..4. PTEROSTEGIA.

Bracts not saccate or enlarged in fruit.

Bracts none; stamens 9....................5. PHYLLOGONUM.

Bracts woolly; flowers in clusters.

Calyx glabrous; stamens 3....................6. NEMACAULIS.

Calyx woolly; stamens 5 to 9....................7. HOLLISTERIA.

Bracts naked; stamens 3....................8. LASTARRIAEA.

Flowers borne in a tubular or turbinate involucre.

Involucral teeth spine- or bristle-tipped.

Involucre mostly 5 or 6-toothed, usually 1-flowered; stamens 3, 6, or 9; involucral lobes usually tipped with hooked spines....................9. CHORIZANTHE.

Involucre 4 or 5-cleft (usually deeply), 2 to many-flowered; stamens 9; involucral lobes ending in straight bristles....................10. OXYTHECA.

Involucre 3 to 8-toothed, the teeth not bristle-tipped....................11. ERIOGONUM.

1. **POLYGONUM** L. KNOTWEED.

Herbs, some water plants, some woody at base. Leaves entire, alternate, with scarious sheathing stipules (''sheaths''), these entire, ciliate or lacerate. Inflorescence various, the flowers on jointed pedicels. Calyx red, white, or sometimes greenish, in all ours 5-cleft or -parted, the divisions erect in fruit. Stamens 4 to 9. Styles 2 or 3. Achene lenticular or triangular, enclosed in the fruiting calyx. Embryo curved, lying in a groove at an angle of the endosperm.—About 160 species, all continents. (Greek polus, many, and gonu, knee, on account of the nodose zigzag stem of many species.)

A. Leaves not cordate.

1. *Flowers in axillary clusters or in spikes, racemes or panicles.*

Leaves ample, not jointed to the petiole.

Alpine or subalpine perennials with thick rootstocks; stamens 8; achene triquetrous.

Flowers in a single dense terminal raceme; stem simple; herbage glabrous.—Subgenus BISTORTA....................1. *P. bistortoides.*

Flowers in clusters or panicles; calyx articulated with the pedicel.—Subgenus ACONOGON.

Flowers numerous in panicles....................2. *P. alpinum.*

Flowers 2 to 4 in axillary clusters....................3. *P. davisiae.*

Low valleys or at middle altitudes; flowers in spikes (usually geminate or paniculate), with small scarious bracts; calyx appressed to the triquetrous or lenticular achene; stamens 4 to 8, filaments filiform; sheaths cylindrical, truncate, entire.—Subgenus PERSICARIA.

Spikes 1 or 2; flowers red; stamens 5, exserted; achene lenticular; aquatic or marsh perennials.

Leaves elliptical or oblong; spikes oblong or ovate, ½ to 1 inch long.................... 4. *P. amphibium.*

Leaves ovate-lanceolate; spikes more elongated, 1 to 3 inches long.................... 5. *P. muhlenbergii.*

Spikes several to many, in 2s or more or less paniculate; stamens 6 to 8, included; achene either lenticular or triangular; stream borders or marshy places.

Sheaths naked in age; spikes often drooping; sepals white or flesh-color; stamens 6; annual....................6. *P. lapathifolium.*

Sheaths truncate or truncatish, fringed with bristles; spikes erect.

Calyx not punctate.

Internodes strongly swollen above the nodes........7. *P. fusiforme.*

Internodes not swollen.

Herbage mostly glabrous; annual....................8. *P. persicaria.*

Herbage strigillose; perennial....................9. *P. hydropiperoides.*

Calyx punctate; perennial....................10. *P. acre.*

Leaves mostly narrow and lanceolate, jointed upon a short petiole adnate to the short sheath of the scarious stipules; flowers in axillary clusters, the clusters either more or less separated or crowded into a terminal leafy spike; stamens mostly 8, the filaments or some of them often dilated at base; achene triquetrous.—Subgenus AVICULARIA.
Perennial and more or less suffrutescent.
Leaves revolute; flowers several in a cluster, crowded at the ends of the branches.... 11. *P. paronychia.*
Leaves plane; flowers 1 to 3 in each axil, less crowded.
Leaves linear; dry foothills..................................12. ***P. bolanderi.***
Leaves oblong or obovate; alpine...13. *P. shastense.*
Annuals.
Plants prostrate; branches leafy to the ends.............................14. *P. aviculare.*
Plants erect or ascending.
Flowers in axillary clusters; leaves little reduced upwards.
Achenes dull..15. *P. ramosissimum.*
Achenes shiny...16. *P. minimum.*
Flowers in very loose spikes; leaves much reduced upwards; plants ½ to 1½ feet high.
Flowers deflexed; achenes black, shining.....................17. *P. douglasii.*
Flowers erect; achenes brownish, dull...........18. *P. spergulariaeforme.*
Flowers in dense terminal leafy spikes; plants ½ to 4 inches high.
Flowers greenish white; "achene brown"............19. *P. imbricatum.*
Flowers whitish or rose-color; "achene black"..........20. *P. watsonii.*

2. *Flowers strictly solitary in the axils of the leaves or bracts.*

Internodes in ours very short and the branches spike-like; stamens 8; achene triquetrous; leaves very narrow, not jointed to the lacerate stipule; ours slender wiry brittle annuals.—Subgenus DURAVIA.
Sheaths conspicuously lacerate.
Stems flowering above the base; sheaths lacerate into more or less bristle-like segments..21. *P. californicum.*
Stems flowering from very base; stipules cottony......................22. *P. parryi.*
Sheaths 2-parted, the segments sharply but shortly toothed............23. *P. bidwelliae.*

B. Leaves cordate.

Flowers in loose panicled racemes; stamens 8; achene triquetrous; twining plants.—Subgenus BILDERDYKIA..24. *P. convolvulus.*

1. **P. bistortoides** Pursh. Stems several from a thick horizontal rootstock, 1 to 2¼ feet high, the leaves mostly basal, those above reduced and bract-like; leaves erect, oblong to linear-oblong, 4 to 8 inches long, the petioles half to as long; raceme dense, spike like, ¾ to 1½ inches long; flowers white, on slender pedicels, 2 to 4 lines long.

High wet meadows in the Sierra Nevada, San Bernardino Mts. and North Coast Ranges. East to the Rocky Mts. and far northward.

Locs.—Mt. San Jacinto, *Hall* 2358; Hocketts Mdws., Tulare Co., *Hall & Babcock* 5604; Giant Forest (Round Meadow was white with its flowers in June, 1900), *Jepson* 708; Twin Lakes, Alpine Co., *Hansen* 315; Bear Valley, Nevada Co., *Jepson;* Goosenest Mt., *Butler* 969; Morgan, Tehama Co., *Hall & Babcock* 4331; Sisson, *Hall & Babcock* 4070; Shackelford Cañon, *Chandler* 1708; Modoc Co., *M. S. Baker;* Trinity Summit, *Goddard* 103; South Yollo Bolly, *Jepson;* Snow Mt. (acc. Zoe, 1: 175); Sherwood Valley, *Davy* 5160.

Refs.—POLYGONUM BISTORTOIDES Pursh, Fl. 1: 271 (1814), type loc. Weippe, Idaho, *Capt. Lewis;* Piper, Contrib. U. S. Nat. Herb. 11: 230 (1906); Small, Monog. N. Am. Polygonum, 28, pl. 1 (1895). *P. bistorta* Wats. Bot. Cal. 2: 14 (1880), not L. *P. cephalophorum* Greene, Pitt. 5: 198 (1903), type loc. Mt. Conness, 3 Aug., 1890, *Harford.* *P. bernardinum* Greene, l. c. 199, type loc. Bluff Lake, San Bernardino Mts., *Parish.* *Bistorta leptophylla* Greene, Leaflets, 1: 20 (1904), type loc. high Sierra Nevada, *Bolander.*

2. **P. alpinum** All. Stems stout, erect, 2 to 7 feet high, arising from a fleshy rootstock, 1 to 2 inches in diameter; herbage glabrous or nearly so; leaves ovate, acuminate, 3 to 6 inches long, the short petiole narrowly wing-margined to the base; panicles terminal, loose, nearly or quite leafless, 3 to 7 inches long; flowers white.

Subalpine, Yosemite to Mt. Shasta and west to Marble Mt.

Locs.—Lake Tenaya, *Hall & Babcock* 3635; Hetch-Hetchy, *Jepson* 3488; Silver Lake, *Hansen* 314; Donner Lake, *Heller* 7123; Bear Valley, Nevada Co., *Jepson;* Klamath Range, *Jepson* 2883.

Refs.—POLYGONUM ALPINUM All. Fl. Pedem. 2: 206, t. 68, fig. 1 (1785), type European;

Small, Mem. Columbia Coll. Dept. Bot. 1: 32, pl. 3 (1895). *P. polymorphum* Ledeb.; Wats. Bot. Cal. 2: 15 (1880). *P. phytolaccaefolium* Meisn.; Small, Bull. Torr. Club, 19: 360 (1892), the type from California; Mem. Columbia Coll. Dept. Bot. 1: 34, pl. 4 (1895).

3. **P. davisiae** Brew. Stems simple or sparingly branched, 5 to 11 inches high, several from the crown of a thick taproot 1 or 2 inches in diameter; leaves ovate or oblong-ovate, minutely pubescent, often glaucous, ¾ to 1½ inches long, subsessile or shortly petioled; flowers purplish green or yellowish, 2 to 4 in loose terminal or axillary clusters; achene half exserted from the persistent calyx.

High mountains, northern Sierra Nevada and North Coast Ranges, 6000 to 8000 feet.

Locs.—Snow Mt. (acc. Zoe, 4: 175); South Yollo Bolly, *Jepson*; Marble Mt., *Jepson* 2843; Trinity Summit, *Jepson* 2053; Salmon Mts., *Hall* 8619; Mt. Shasta; Lassen Peak, *E. M. Austin*; Placer Co., *Carpenter*; Carson Spur, *Hansen* 711. Mt. Lola, Nev., *Kennedy & Doten*.

Refs.—POLYGONUM DAVISIAE Brew.; Gray, Proc. Am. Acad. 8: 399 (1872), type loc. northern Sierra Nevada, *Brewer, Torrey, Miss N. J. Davis*; Small, Monog. N. Am. Polygonum, 38, pl. 6 (1895). *P. newberryi* Small; Merriam, N. Am. Fauna, 16: 145 (1899).

4. **P. amphibium** L. WATER PERSICARIA. Aquatic glabrous perennial with stout stems not branching above the rooting base; leaves floating, elliptical to oblong or oblong-lanceolate, truncate or rounded at base, 2 to 7 inches long on petioles ⅞ to 2½ inches long; sheaths leaf-bearing at about the middle; spike terminal, dense, ovate or oblong, ½ to 1 inch long, on a commonly short peduncle; calyx bright rose-color, 1½ to 3 lines long, the 5 stamens and 2-cleft style exserted; achene lenticular.

Ponds and lakes in Southern California and the Sierra Nevada, north to British Columbia and east to the Atlantic. Europe; Asia. Often terrestrial and almost equally successful as a land or water plant.

Locs.—Bluff Lake, San Bernardino Mts., *Nora Pettibone*; Kern Cañon, *Jepson* 1046; Hetch-Hetchy, *Chesnut & Drew*; Lake Tahoe, *Brewer* 2136; Donner Lake, *Heller* 7162; Placer Co., *Carpenter*; Silver Lake, Lassen Co., *Baker & Nutting*.

Var. **hartwrightii** Bissel. Sheaths rough-hairy, ciliate, usually with an abruptly spreading herbaceous margin. Upper Sacramento Valley and northern Sierra Nevada; eastward to the Atlantic.

Refs.—POLYGONUM AMPHIBIUM L. Sp. Pl. 361 (1753), type European; Small, Monog. N. Am. Polygonum, 40, pl. 7 (1895). *Persicaria purpurata* Greene, Leaflets, 1: 27 (1904), type loc. Silver Lake, Lassen Co., *Baker & Nutting*. *P. insignis* Greene, l. c. 32, type loc. San Bernardino Mts., 9550 ft., *Wright* 1809. Var. HARTWRIGHTII Bissel, Rhod. 4: 105 (1902). *Polygonum hartwrightii* Gray, Proc. Am. Acad. 8: 294 (1870), type loc. New York, *Hart Wright*; Greene, Fl. Fr. 136 (1891).

5. **P. muhlenbergii** Wats. Perennial, aquatic or in half dry places; stems decumbent or suberect, 2 to 3 (or 6) feet high; leaves and upper portion of the simple stem usually appressed-hirsutulose or scabrous, the peduncle glandular with short hairs; leaves thin, ovate-lanceolate to lanceolate, acuminate or even attenuate, usually rounded at base, 3 to 8 inches long, the petioles 1 to 3½ inches long; spikes 1 to 4 inches long, often in pairs; calyx rose-color or pink, 5-parted to the middle; stamens 5, exserted; style 2-cleft; achene lenticular.

Lakes and sluggish streams from the coast to the Sacramento Valley. Throughout North America.

Locs.—Cache Slough, Solano Co., *Jepson*; San Francisco, *Jepson*; Gilroy, *Jepson*; San Luis Obispo, *Jepson* 3069; Healdsburg, *Alice King*; Klamath River, Siskiyou Co., *Butler* 193; Honey Lake Valley, *Davy* 3321.

Refs.—POLYGONUM MUHLENBERGII Wats. Proc. Am. Acad. 14: 295 (1879), type from U. S.; Jepson, Fl. W. Mid. Cal. 161 (1901). *P. emersum* Britt. Trans. N. Y. Acad. Sci. 8: 73 (1889); Small, Monog. N. Am. Polygonum, 44, pl. 9 (1895). *Persicaria franciscana* Greene, Leaflets, 1: 42 (1904), type loc. Mountain Lake, S. F. *P. hesperia* Greene, l. c. 43, type loc. Searsville, San Mateo Co., *C. F. Baker* 1835. *P. alismaefolia* Greene, l. c. 44, type loc. Cloverdale, *Heller* 5823. *P. covillei* Greene, l. c., type loc. Visalia, *Coville & Funston* 1266.

6. **P. lapathifolium** L. COMMON KNOTWEED. WILLOW-WEED. Annual, commonly stout, 1 to 4 feet high, branching; herbage glabrous except a very

scanty glandular pubescence on the peduncles and a scabrous pubescence on the leaf-margins or the leaves beneath sometimes resin-dotted; leaves broadly lanceolate, mostly long-acuminate, cuneate at base, 4 to 5 inches long, short-petioled; spikes axillary and terminal, oblong and erect or linear and nodding, 1 inch long or more; bracts ovate, acute; calyx white or flesh-color; stamens 6, included; achene lenticular or rarely triangular.

Common along streams or in marshy lands, often whitening great areas. Aug.-Sept.

Locs.—Yreka, *Butler* 196; Howell Mt., *Jepson;* lower Sacramento River, *Jepson;* Ione, *Braunton* 1181; West Berkeley, *Jepson;* Alvarado, *Jepson;* Los Buellis Hills, Santa Clara Co., *R. J. Smith;* Bakersfield, *Heller* 7839; Lone Pine, *Jepson* 5150; Los Angeles, *Elizabeth Palmer;* Ramona, *K. Brandegee;* Calexico, *Parish* 8075.

Var. **incanum** Koch. Small, slender; leaves whitish beneath.—Berkeley, etc.

Refs.—POLYGONUM LAPATHIFOLIUM L. Sp. Pl. 360 (1753), type European; Small, Monog. N. Am. Polygonum, 54, pl. 14 (1895); Jepson, Fl. W. Mid. Cal. 161 (1901). *P. nodosum* Pers. Syn. 1: 440 (1805). *P. incarnatum* Auct. Var. INCANUM Koch, Syn. Fl. Germ. 711 (1837).

7. **P. fusiforme** Greene. Stems several or many from the base, dark red, assurgent, 2 to 3 feet high, the internodes fusiform-thickened above the nodes; leaves linear-lanceolate, acuminate at both ends, glabrous or strigulose on midrib, 2½ to 4 inches long, subsessile; sheaths strigulose outside and at first shortly ciliate at summit; bracts obtuse, shortly ciliate; racemes dense, 1 to 1½ inches long, usually paniculate; calyx red in bud, mostly white in anthesis, its segments 5 (or 4); stamens "4" to 7; achene "lenticular" or triquetrous, black, shining.

Colorado River Valley: Palo Verde, *Jepson* 5280.

Refs.—POLYGONUM FUSIFORME Greene, Erythea, 1: 259 (1893), type loc. Colorado River near The Needles, *N. C. Wilson;* Small, Monog. N. Am. Polygonum, 70, pl. 22 (1895). Perhaps too near P. persicarioides H.B.K. of New Mexico and Mexico.

8. **P. persicaria** L. LADY'S THUMB. Annual; resembling P. lapathifolium but sheaths strigose and the sheaths and truncatish bracts ciliate; leaves subsessile; spikes shorter and erect; calyx red or white, not glandular; stamens generally 6, included.

Widely distributed in North America. Naturalized from Europe.

Locs.—(?) Lone Pine, *Jepson* 5151; St. Helena, *Jepson;* lower Sacramento River, *Jepson;* Navarro, *Byxbee;* Humboldt Co., *Chesnut & Drew.*

Refs.—POLYGONUM PERSICARIA L. Sp. Pl. 361 (1753), type European; Small, Monog. N. Am. Polygonum, 66, pl. 20 (1895). *P. arcuatum* Greene, Pitt. 5: 201 (1903), type loc. Napa River.

9. **P. hydropiperoides** Michx. Perennial; stems 1 to 3 feet high, branching; sheaths hairy; spikes slender or filiform, often interrupted below; calyx small, flesh-color or whitish, not dotted; stamens 8.

Southern California: San Bernardino, acc. *Parish;* streams near the coast, acc. *Abrams;* Visalia, acc. *Coville.*

Refs.—POLYGONUM HYDROPIPEROIDES Michx. Fl. Bor. Am. 1: 239 (1803), "Pennsylvania, Virginia, Carolina"; Small, Monog. N. Am. Polygonum, 80, pl. 27 (1895); Abrams, Fl. Los Ang. 122 (1904); Cov. Contrib. U. S. Nat. Herb. 4: 191 (1893).

10. **P. acre** H.B.K. DOTTED SMART-WEED. Perennial, rooting and decumbent at base, erect and branching above, 2 to 5 feet high, glabrous or the margin of the leaves scabrous; leaves ovate-lanceolate to linear-lanceolate, acuminate, attenuate to a very short petiole, 2 to 3 inches long; sheaths mostly bristly-ciliate, the short truncate bracts mostly naked; spikes loose and slender, 1 to 3 inches long, erect on long peduncles or panicled; calyx greenish, conspicuously glandular-dotted; stamens 8; achene lenticular or triangular.

Common in low and especially marshy ground or in moist mountain meadows. Sept. An important bee-plant along the Sacramento River, the honey yield as heavy as from alfalfa (M. C. Richter).

Locs.—Trinity River valley, *Tracy* 3473; Howell Mt., *Jepson*; Napa River, *Jepson*; Berkeley, *Jepson*; Milpitas, *R. J. Smith*; San Mateo Co., *Jepson* 4159; Moss Lndg., Monterey Co., *Abrams* 4051; San Luis Obispo, *Jepson* 3068; Irishtown, Amador Co., *Hansen* 754; Witch Creek, *Alderson*.

Refs.—POLYGONUM ACRE H.B.K. Nov. Gen. et Sp. 2: 179 (1817), type trop. Am. *P. punctatum* Ell. Bot. S. C. & Ga. 1: 455 (1821); Small, Monog. N. Am. Polygonum, 88, pl. 31 (1895).

11. **P. paronychia** C. & S. Stems from large woody rootstocks, suffrutescent, prostrate or ascending, 1 to 3 feet long; branches leafy above, below clothed with old sheaths; sheaths large, 4 to 6 lines long, brown and 5-nerved, the margin freely lacerate above, persistent, the segments becoming hair-like in age; leaves linear-lanceolate, 5 to 8 (or 11) lines long, acute, the margin revolute; flowers about 3 in an axil, on short pedicels, densely crowded at the ends of the branches in short more or less leafy spikes; sepals white or rose-color, oblong-ovate, the green midvein with pinnately toothed outline; stamens 8, the 3 inner dilated at base.

Sand hills along the coast: middle California north to British Columbia.

Locs.—Monterey, *Berg*; San Francisco, *Setchell*, *Jepson*; Pt. Reyes, *Davy* 6877; Bucksport, *Tracy* 3200; Requa, *Goddard*.

Refs.—POLYGONUM PARONYCHIA C. & S. Linnaea, 3: 51 (1828), type loc. San Francisco, *Chamisso*, *Eschscholtz*; Small, Monog. N. Am. Polygonum, 94, pl. 34 (1895); Jepson, Fl. W. Mid. Cal. 159 (1901).

12. **P. bolanderi** Brew. Stems many, erect, 5 to 10 inches high, arising from a woody taproot or from prostrate woody branches; leaves narrowly linear to subulate, acute or cuspidate, 2 to 8 lines long, not revolute; sheaths persistent, 2-lobed on each side, the lower lobes finely lacerate; flowers white or rose-color, 1 or occasionally 2 in the axils on the branchlets; stamens 8 or 9.

Rocky outcroppings, Napa and Mt. Hood ranges. Possibly also at Salida, Stanislaus Co. July-Sept.

Refs.—POLYGONUM BOLANDERI Brew.; Gray, Proc. Am. Acad. 8: 400 (1872), type loc. Napa Valley, *Brewer*, *Bolander*; Small, Monog. N. Am. Polygonum, 140, pl. 57 (1895); Jepson, Fl. W. Mid. Cal. 159 (1901).

13. **P. shastense** Brew. Stems mostly simple, 2 to 6 inches long, several from the branching crown of a perennial root; leaves oblong or obovate, 3 to 4 inches long; stipules broad, silvery; flowers red or white, 2 or 3 in the axils; stamens 8.

High Sierra Nevada, 7000 to 9000 feet; north to Mt. Mazama, Oregon.

Locs.—Mt. Shasta, *Jepson*; Lassen Peak, *Mrs. R. M. Austin*; Donner Pass, *Heller* 7151; Pyramid Peak, *Hall & Chandler* 4744; Long Mdw., Tuolumne Co., *Chesnut & Drew*; Mt. Goddard, *Hall & Chandler* 684; Mt. Silliman, *K. Brandegee*. Mt. Rose, Nev., *Kennedy* 1137.

Refs.—POLYGONUM SHASTENSE Brew.; Gray, Proc. Am. Acad. 8: 400 (1872), type spms. from Mt. Shasta and Carson Pass, *Torrey*, *Brewer*; Small, Monog. N. Am. Polygonum, 96, pl. 35 (1895); Merriam, N. Am. Fauna, 16: 144 (1899).

14. **P. aviculare** L. WIRE GRASS. YARD GRASS. Annual; stems wiry, minutely striate, prostrate or ascending, often several feet long, flowering from the base; herbage glabrous and green; leaves oblong, acute, 3 to 6 lines long; flowers on very short pedicels, 2 lines broad when expanded; calyx cleft, the oblong lobes white with a green center; stamens 8, the 3 inner with dilated bases; styles 3, very short; achene ovoid, dark brown, minutely granular.

Naturalized from Europe; common in hard, especially beaten soils, and sometimes in cultivated lands; flowering through the dry season and until after the rains break. Var. LITTORALE Koch. Leaves thick, often obtuse. —Maritime form.

Refs.—POLYGONUM AVICULARE L. Sp. Pl. 362 (1753), type European. Var. LITTORALE Martens & Koch, Deutsche Fl. 3: 59 (1831).

15. **P. ramosissimum** Michx. Annual, with the aspect of P. aviculare but erect and 1 to 2 feet high; leaves oblong to lanceolate, $\frac{3}{4}$ to $1\frac{1}{4}$ inches long, somewhat reduced above; calyx greenish or yellowish; stamens 3 to 6; achene black, dull.

California; north to Saskatchewan and east to the Atlantic.

Locs.—Pasadena, *Grant* 1020; Yosemite, *Hall* 9131. Rarely noted in Cal.

Refs.—POLYGONUM RAMOSISSIMUM Michx. Fl. Bor. Am. 1: 237 (1803), type loc. Illinois. *P. erectum* Wats. Bot. Cal. 2: 11 (1880), not L.

16. **P. minimum** Wats. Annual; stems usually several from the base, 2 to 4 (or 6) inches long, ascending; herbage glabrous, scaberulous at the nodes; leaves ovate or elliptic, 2 to 6 lines long, apiculate, evenly distributed or somewhat crowded at ends of branches; flowers in all the axils, greenish white; stamens 5 to 8; achene slightly exserted, black, smooth, shining.

Central Sierra Nevada to Siskiyou Co., 4000 to 7000 feet; north to Alaska, east to Utah.

Locs.—Mt. Watkins, *Hall* 9170; Donner, *Brandegee*; Shackelford Creek, *Butler* 1776.

Refs.—POLYGONUM MINIMUM Wats. Bot. Kings, 315 (1871), type loc. Wahsatch and Uintah mountains, Utah; Small, Monog. N. Am. Polygonum, 128, pl. 51 (1895).

17. **P. douglasii** Greene. Annual, mostly sparingly branched and strictly erect, 8 to 21 inches high; leaves linear-oblong or -lanceolate, acute, thinnish, 1 to 1¼ inches long; sheaths lacerate; flowers reddish, 2 lines long, scattered, on deflexed pedicels; achene triquetrous, jet-black, smooth and shining.

High mountains, California, 4000 to 8000 feet; north to British Columbia, east to Texas and Maine.

Locs.—Volcano Creek, *Jepson* 956; Yosemite, *Jepson* 5668; Bear Valley, Nevada Co., *Jepson*; South Yollo Bolly, *Jepson*. The following have the achene smooth and shining on the angles but otherwise dull black and slightly roughened like morocco leather: Bluff Lake, San Bernardino Mts., *Nora Pettibone*; Bubbs Creek, *Jepson* 780; Sisson, *Jepson*.

Var. **latifolium** Greene. Leaves oblong; flowers mostly crowded towards the ends of the branches.—Pacific Coast.

Var. **austinae** Jones. Leaves ovate to lanceolate, 3 to 6 lines long; calyx green with whitish margins, 1 line long; achene black, smooth and shining. —Modoc Co., northerly to Idaho.

Refs.—POLYGONUM DOUGLASII Greene, Bull. Cal. Acad. 1: 125 (1885), type from western America; Fl. Fr. 134 (1891); Small. Monog. N. Am. Polygonum, 118, pl. 46 (1895). Var. LATIFOLIUM Greene, ll. cc. *P. tenue* Wats. Bot. Cal. 2: 12 (1880), not Michx. Var. *latifolium* Engelm. in Wats. l. c. *P. montanum* Greene, Pl. Bak. 3: 13 (1901). Var. AUSTINAE Jones, Contrib. 12: 75 (1908). *P. austinae* Greene, Bull. Cal. Acad. Sci. 1: 212 (1885), type loc. Modoc Co., sagebrush plains, *R. M. Austin*.

18. **P. spergulariaeforme** Meisn. Annual, much branched and somewhat diffuse, or sparingly branched and more strictly erect, 4 to 13 inches high; sheaths with a short mostly scarious base and lacerate summit; leaves linear or oblanceolate, 1-nerved, acute, ½ to 1½ inches long; spikes 4 inches long or less, very slender, the flowers much scattered below, crowded above; calyx rose-color or white; stamens 8, included, the filaments hardly dilated at base; style as long as the ovary, 3-parted.

Dry hills: North Coast Ranges to British Columbia in the coast region. Oct.

Locs.—Grouse Creek, Humboldt Co., *Chesnut & Drew*; Sisson, *Jepson*; Humbug Creek, Siskiyou Co., *Butler* 195.

Refs.—POLYGONUM SPERGULARIAEFORME Meisn.; Small, Bull. Torr. Club, 19: 366 (1892), type loc. Pacific Coast; Small, Monog. N. Am. Polygonum, 130, pl. 52 (1895). *P. coarctatum* Dougl.; Wats. Bot. Cal. 2: 12 (1880). *P. howellii* Greene, Pl. Bak. 3: 14 (1901), type loc. Siskiyou Mts., *Howell*. *P. exile* Eastw. Proc. Cal. Acad. ser. 3, Bot. 2: 286 (1902), type loc. Kings Cañon, *Eastwood*; stamens 3.

19. **P. imbricatum** Nutt. Annual; stem branching from the base or sometimes simple, erect, 1 to 3 inches high, the upper leaves scarcely smaller but crowded and with flowers crowded in their axils; leaves linear, acute, 3 to 5 lines long; stipules 2-cleft, the lower segments of each pair more or less united; flowers greenish white, very shortly pedicelled; stamens 5; styles nearly obsolete; achene brown, dull, smooth.

Sierra Nevada, 6000 to 8000 feet, Yosemite Park to Donner Lake; north to Washington and east to Colorado. Probably no more than a low-branching form of P. watsonii.

Locs.—N. Fork Kings River, *Hall & Chandler* 4431; Ostrander's Mdw. near Yosemite, *Bolander* 6005; Lake Merced, *Jepson* 4421; Placer Co., *Carpenter;* Lassen Peak, *Jepson* 4075.

Refs.—POLYGONUM IMBRICATUM Nutt.; ,Wats. Am. Nat. 7: 665 (1873), type from the western U. S.; Piper, Contrib. U. S. Nat. Hb. 11: 228 (1906). *P. kelloggii* Greene, Fl. Fr. 134 (1891), type loc. Donner Lake; Small, Monog. N. Am. Polygonum, 134, pl. 54 (1895).

20. **P. watsonii** Small. Annual; stem simple or branching above the base, erect, ½ to 4 inches high, the terminal portion of the stem or branches crowded with leaves and flowers; leaves linear to lanceolate, ½ to 1 inch long or the uppermost 1 to 3 lines long; stipules deeply cleft into 2 lanceolate or ovate acuminate entire segments; flowers whitish or rose-color, 1 or 2 in each axil; stamens 3 to 5; styles evident; achene dark or black, the surface lightly lineate or very shallowly alveolate.

Alpine or subalpine, Sierra Nevada, 9000 to 10,000 feet, south to Mt. San Jacinto, north to British Columbia and east to Colorado.

Locs.—Willow Creek, Modoc Co., *Austin;* Truckee, *Sonne;* Cisco, *Harriet Walker* 1299; Snow Creek, Yosemite, *Hall* 9187; Eagle Peak, Yosemite, *Jepson* 4371; Pine Ridge, Fresno Co., *Hall & Chandler* 191; West Vidette, *Jepson* 826; Kearsarge Pass, *Jepson* 883; Cottonwood Creek, Inyo Co., *Jepson* 5071; Mt. San Jacinto, *Hall* 2354.

Refs.—POLYGONUM WATSONII Small, Monog. N. Am. Polygonum, 138, pl. 56 (1895), excluding syn. type from the western U. S.; Piper, Contrib. U. S. Nat. Herb. 11: 228 (1906).

21. **P. californicum** Meisn. Slender wiry glabrous annual, 3 to 7 inches high, diffusely branched, the ultimate branches elongated and floriferous; leaves linear to filiform, cuspidate, 3 to 8 lines long, the back with strong midrib and revolute-ribbed on each margin; spikes often loose below, usually dense above with the sheaths overlapping; bracts lanceolate or subulate, 1 to 3 lines long; sheaths split to the middle or to the base into setaceous divisions; sepals white with rose-colored midvein; achene brown.

Dry foothills, Sierra Nevada and North Coast Ranges; north to Washington. July.

Locs.—N. Fork Kaweah, *Jepson* 580; Hazel Green, Yosemite Park, *Jepson;* La Grange, *Jepson;* Sheep Ranch, Calaveras Co., *Davy* 1613; Milton, *Davy* 1227; Ione, *Braunton* 1228; Sweetwater, El Dorado Co., *K. Brandegee;* Chico, *R. M. Austin;* Napa Valley, *Jepson;* Blue Lakes to Ukiah, *Jepson;* Mt. Sanhedrin, *Jepson;* Hullville, Lake Co., *Heller* 6066; Van Duzen River, *Tracy* 2922.

Refs.—POLYGONUM CALIFORNICUM Meisn. in DC. Prodr. 14: 100 (1856), type loc. east side of the Sacramento Valley, *Hartweg* 1944; Small, Monog. N. Am. Polygonum, 142, pl. 58 (1895); Jepson, Fl. W. Mid. Cal. 160 (1901). *P. greenei* Wats. Proc. Am. Acad. 14: 295 (1879), type spms. from Shasta Valley, *Greene*, and Chico, *Mrs. Bidwell;* Small, Monog. N. Am. Polygonum, 144, pl. 59 (1895); this is habitally like *P. californicum*, and is technically without distinctive characters.

22. **P. parryi** Greene. Dwarf compact annual, commonly branching from the base, 1 to 2 inches high; stems rigid and brittle, spike-like, because densely crowded with leaves and flowers even to the base; leaves narrowly linear, acute, cuspidate, 1 to 4 lines long; stipules so extremely lacerate as to appear cottony, and often hiding the flowers; achene triangular, chestnut-color.

Sierra Nevada; higher North Coast Ranges; north to Washington. June-July.

Locs.—Howell Mt., *Tracy* 1550; Gravelly Valley, Lake Co., *Jepson;* Buck Mt., Humboldt Co., *Tracy* 2832; Bear Valley, Nevada Co., *Jepson.*

Refs.—POLYGONUM PARRYI Greene, Bull. Torr. Club, 8: 99 (1881), type loc. Yosemite Valley, *Parry;* Small, Monog. N. Am. Polygonum, 146, pl. 60, fig. 1 (1895).

23. **P. bidwelliae** Wats. Annual; stems divergently branched, 1 to 4 inches high; leaves linear, 3 to 5 lines long, with a strong midrib and two marginal nerves on back; stipules ovate, sharply serrate or at length lacerate, imbricated on the spikes; calyx rose-color.

Chico; not otherwise known.

Refs.—POLYGONUM BIDWELLIAE Wats. Proc. Am. Acad. 14: 294 (1879), type loc. Chico, *Mrs. John Bidwell;* Small, Monog. N. Am. Polygonum, 146, pl. 60, fig. 2 (1895).

24. **P. convolvulus** L. BLACK BINDWEED. Twining or trailing annual, the stems 1 to several feet long; herbage glabrous, pale green; leaves 1 to 2 inches long, ovate, sagittate at base, acuminate at apex; flowers in axillary clusters or disposed in a raceme; calyx 5-cleft, in fruit minutely scurfy, closely investing the black achene.

Naturalized from Europe: Sisson; Ft. Bidwell; Yosemite; San Francisco.

Refs.—POLYGONUM CONVOLVULUS L. Sp. Pl. 364 (1753), type European; Small, Monog. N. Am. Polygonum, 148, pl. 61 (1895).

2. RUMEX L.

Weed-like herbs, ours perennial except one. Leaves mostly basal, those on the stem alternate, the petioles with somewhat sheathing stipules. Flowers mostly greenish, sometimes reddish or yellowish, pediceled and borne in usually crowded whorls along the branches of the panicle. Calyx of 6 nearly distinct sepals, the 3 outer spreading or reflexed, the 3 inner larger, continuing to grow after flowering and hugging the achene, 1 or more of them in many of our species bearing a wart or callous grain on the back. Fruits, therefore, more conspicuous than the flowers. Stamens 6. Styles 3, short; stigmas tufted (wind-pollinated) and maturing before the stamens. Achene triangular.—About 110 species, all continents but mainly north temperate. (Old Latin name used by Pliny.)

Flowers perfect or some staminate on the same plant; inner sepals commonly reticulated, in fruit becoming much longer than the achene; pedicels jointed; roots yellow, scented, bitter.—LAPATHUM DC. (Docks).
- Inner fruiting sepals entire (or nearly so) and
  - Without callous grains; pedicels not very prominently jointed.
    - Leaves rounded to acute at base.
      - Inner fruiting sepals broader than long..................1. *R. venosus.*
      - Inner fruiting sepals longer than broad............2. *R. hymenosepalus.*
    - Leaves cordate at base...................................3. *R. occidentalis.*
  - With callous grains (or 1 or 2 of the sepals naked), 1 to 2½ lines long; pedicels prominently jointed near the base.
    - Leaves strongly undulate, elliptical to oblong-lanceolate; fruiting sepals with a broad wing bordering the callous grain..................4. *R. crispus.*
    - Leaves slightly undulate; callous grain nearly covering fruiting sepals, leaving only a narrow wing.
      - Leaves linear, spatulate or oblong; callous grain toothed..5. *R. berlandieri.*
      - Leaves oblong or ovate; callous grain not toothed....6. *R. conglomeratus.*
    - Leaves plane, mostly lanceolate; fruiting sepals triangular, usually much larger than the callous grain............................7. *R. salicifolius.*
- Inner fruiting sepals with very prominent slender teeth or bristles; callous grains 1 to 3.
  - Perennial; flowering branches elongated and
    - Spreading at wide angles; pedicels jointed near the middle.....8. *R. pulcher.*
    - Suberect; pedicels jointed near the base..................9. *R. obtusifolius.*
  - Annual; flowering branches usually short, the whorls mostly spicate-crowded; pedicels jointed near the base..............................10. *R. persicarioides.*

Flowers dioecious; callous grains none or minute; roots red, scentless.—ACETOSA DC. (Sorrels).
- Leaves not lobed; sepals longer than achene; pedicels jointed.......11. *R. paucifolius.*
- Leaves hastate; sepals shorter than achene; pedicels not jointed......12. *R. acetosella.*

1. **R. venosus** Pursh. Stems erect, ¾ to 1½ feet high, from a running rootstock; leaves ovate or lanceolate, 2½ to 4 (or 6) lines long, on short petioles, with conspicuous dilated stipules; panicle nearly sessile, short, dense in fruit; inner fruiting sepals entire, without grains, round-cordate, 6 to 8 lines long and 8 to 14 lines broad.

Dry sandy valleys: Honey Lake Valley, Lassen Co., not otherwise known in California. Nevada north to Washington and east to Missouri.

Refs.—RUMEX VENOSUS Pursh, Fl. 2: 733 (1814), type from the Missouri River region; Trel. Rep. Mo. Bot. Gard. 3: 79, pl. 17 (1892).

2. **R. hymenosepalus** Torr. CANAIGRE. Stem 1 to 2 feet high, nearly simple, arising from a cluster of 2 to 12 tuberous or dahlia-like roots and end-

ing above in a dense panicle ½ to 1 foot long; leaves oblong or tapering to each end, slightly succulent, somewhat wavy-margined, ½ to 1 foot long; sheathing stipules conspicuous; pedicels jointed near the middle, ½ to nearly as long as the fruit; inner sepals membranous and rosy in fruit, ovate, cordate at base, naked, 4 to 6 lines long.

Dry sandy washes and sandy plains from Kern Co. and Nipoma southward; most abundant on the San Fernando and San Bernardino plains, thence eastward to Arizona and New Mexico. Roots used in tanning leather. The plants do not, however, do well in cultivation, irrigation decreasing the amount of tannin. The leaf-stem is used as a substitute for rhubarb, whence the names Wild Rhubarb, Wild Pie-plant and Sour Dock.

Refs.—Rumex hymenosepalus Torr. Bot. Mex. Bound. 177 (1859), type loc. New Mexico; Trel. Rep. Mo. Bot. Gard. 3: 80, pl. 18 (1892); Jepson, Fl. W. Mid. Cal. ed. 2, 135 (1911).

3. **R. occidentalis** Wats. Western Dock. Erect, glabrous, stout, and nearly simple, 3 to 6 feet high; leaves somewhat fleshy, oblong-ovate or ovate-lanceolate, truncate or cordate at base, 6 to 16 inches long, the petioles of the basal leaves longer than the blade; panicle strict, mostly very dense, 1 to 2 feet long, leafless or with a few small leaves below, rosy in fruit; pedicels 3 to 6 lines long, the joint below the middle obscure; inner fruiting sepals round-ovate, subcordate, naked, or rarely with a callous grain, 2 to 3 lines long.

Marshes in the valleys and marshy spots in the hills: San Francisco Bay region to Lassen Co. and Mt. Shasta. North to Alaska, east to Texas and Labrador. Stems from a taproot, as also in nos. 4 to 8.

Locs.—Berkeley, *Davy* 722; Collinsville, *Jepson*; Denverton, *Jepson*; Humboldt Bay, *Tracy* 3148; Sisson, *Jepson*; Honey Lake Valley, acc. *Davy*.

Refs.—Rumex occidentalis Wats. Proc. Am. Acad. 12: 253 (1877), type N. American; Trel. Rep. Mo. Bot. Gard. 3: 81, pl. 19 (1892); Jepson, Fl. W. Mid. Cal. 156 (1901). *R. procerus* Greene, Pitt. 4: 305 (1901), type loc. marshy spots in coast hills about San Francisco Bay and Monterey.

4. **R. crispus** L. Curly Dock. Stem stoutish, 1½ to 4 feet high; leaves bluish-green, very wavy-margined, elliptical to oblong-lanceolate, 3 to 10 inches long, the petioles 1 or 2 inches long; flowering branches strict with few leaves, the whorls dense, mostly crowded and red-brown in fruit; pedicels twice as long as the fruit, tumidly jointed near the base; inner fruiting sepals broadly ovate, 2 to 2½ lines long, all with smooth callous grains, rarely 1 or 2 naked.

Very common weed in low and neglected lands in valleys and in the mountains to middle altitudes. Naturalized from Europe. The half-fleshy root has astringent and tonic properties. Blade more or less decurrent on the petiole, as in R. conglomeratus.

Refs.—Rumex crispus L. Sp. Pl. 335 (1753), type European; Trel. Rep. Mo. Bot. Gard. 3: 84, pl. 22 (1892); Jepson, Fl. W. Mid. Cal. 157 (1901).

5. **R. berlandieri** Meisn. Mexican Dock. Stem rather stout and succulent, simple, 1 to 2 feet high, from a deep taproot; herbage not glaucous, darker green than in R. salicifolius; leaves linear to spatulate or narrowly oblong, 3 to 4 inches long, petioled; panicles leafless except for the main axis, the whorls dense, remote except above; pedicels prominently jointed below the middle; inner fruiting sepals ovate-triangular, erose or with 2 to 4 minute teeth on each side at base, 1½ to 2 lines long; callous grains mostly unequal, irregularly toothed on each side next to the sepal.

Colorado Desert. East to Texas and south into Mexico.

Locs.—Holtville, *Parish* 8078; Mesquite Lake, *Davy* 8024.

Refs.—Rumex berlandieri Meisn. in DC. Prodr. 14: 45 (1856), type specimens from Tampico, Mex., by *Berlandier*, and elsewhere by others; Trel. Rep. Mo. Bot. Gard. 3: 89, pl. 27 (1892); Tuomey, Ariz. Agr. Exp. Sta. Bull. 22: 23, fig. 8 (1897).

6. **R. conglomeratus** Murr. Green Dock. Stems slender, 3 to 5 feet high, arising from a short mostly vertical rootstock which often crowns one or several fusiform roots; leaves ovate or mostly oblong, slightly undulate, 2 to 4 inches long, reduced above; flowering branches slender, erect, very long (⅓ to 1½ feet), naked or with a lanceolate or ovate leaf subtending some or all of the remote whorls; pedicels as long as, or rather shorter than the fruit, tumidly jointed near the base and geniculate; fruit about 1 line long, the inner sepals oblong with callous grains mostly 3 and smooth.

Naturalized from Europe. Low moist valley lands throughout the state and in the mountains to middle altitudes.

Refs. Rumex conglomeratus Murr. Prodr. Fl. Goett. 52 (1770), type European; Trel. Rep. Mo. Bot. Gard. 3: 90, pl. 28 (1892); Jepson, Fl. W. Mid. Cal. 157 (1901).

7. **R. salicifolius** Weinm. Willow Dock. Low spreading or erect, 1 to 2½ feet high; leaves plane, glaucous, linear-oblong to oblong-lanceolate, acute at both ends, 1½ to 5 inches long, short-petioled; flowering branches short (2 or less commonly 4 inches long), the lateral mostly divaricate; whorls dense, crowded, leafless, or 1 or 2 lower whorls remote and leafy; pedicels rather shorter than the fruit, jointed near the base and recurved but not geniculate; inner fruiting sepals triangular or triangular-ovate, pink-red, 1 to 2 lines long, the white callous grain only 1, or the grains 1, 2 or 3, even in the same panicle.

Wet places in valley lands and in the foothills, ascending to high altitudes in the mountains; distributed nearly throughout California. North to British Columbia. A variable species. We have specimens from Mt. San Jacinto at 6000 feet and from Bullfrog Lake, Sierra Nevada, at 11,000 feet, which are in appearance quite unlike the seaboard type. While one or more of the alpine or interior forms may represent distinct units, the evidence now available to us is insufficient for specific segregation.

Locs.—Eureka, *Tracy* 1157; Vacaville, *Jepson;* Berkeley, *Jepson;* Oakland, *Davy* (grains none); Alvarado, *Jepson;* Santa Barbara, *M. S. Baker;* Elsinore, *McClatchie* 51; Tehipite, *Hall & Chandler* 494; Carson Spur, Alpine Co., *Hansen* 752.

Var. **montigenitus** Jepson n. var. Flowering branches short and panicle more compact; inner fruiting sepals without callous grains or a calyx here and there with the grains subulate or small.—(Panicula compactior; calyx fructifer obsolete callifer undique, raro unus passim cum callibus subulatis parvisve.)—High montane (6000 to 11,000 feet): Yollo Bolly Mts.; Sierra Nevada; south to San Jacinto Mts. Seems conspecific with plants of the Rocky Mt. region more recently referred by authors to R. mexicanus Meisn., but all the forms of this variety are matched by occasional plants of the immediate coast region which we are referring to R. salicifolius.

Refs.—Rumex salicifolius Weinm. in Flora, 4: 28 (1821), type loc. San Francisco, *Chamisso* (Linnaea, 3: 60); Trel. Rep. Mo. Bot. Gard. 3: 87, pl. 26 (1892); Jepson, Fl. W. Mid. Cal. 157 (1901); Fernald, Rhod. 10: 17 (1908). *R. lacustris* Greene, Erythea, 3: 63 (1895), type loc. Silver Lake, Lassen Co., *Baker & Nutting*.

8. **R. pulcher** L. Fiddle Dock. Stem slender but rigid, widely parted into zigzag branches; leaves oblong or fiddle-shaped, 3 to 5½ inches long, petioled; flowering branches simple, divaricate, sparsely leafy, the dense whorls remote or at least distinct, red-brown in fruit; pedicels about equaling the fruit, tumidly jointed in the middle; inner fruiting sepals with 5 to 10 awn-like teeth on each side; callous grains 1 to 3.

Common weed of valley waysides and vacant lots in towns; also in meadows and moist places in the foothills and mountains. Naturalized from Europe.

Refs.—Rumex pulcher L. Sp. Pl. 336 (1753), type European; Trel. Rep. Mo. Bot. Gard. 3: 91, pl. 29 (1892); Jepson, Fl. W. Mid. Cal. 157 (1901).

9. **R. obtusifolius** L. Bitter Dock. Tall, slender, 3 feet high or more; leaves ovate-oblong to oblong-lanceolate, somewhat undulate, acute or obtuse,

truncate or cordate at base, 6 inches long or less, long-petioled; flowering branches in a rather strict panicle, leafless or with a few little-reduced leaves at the base; whorls loose, not crowded, the lower remote, pedicels slender, 1 to 2 times as long as the fruit, tumidly jointed toward the base; inner fruiting sepals ovate-deltoid, 1½ to 3 lines long, with 3 to 5 thin triangular or subulate teeth on each side; grain 1 only or with 2 other small ones.

Naturalized European weed in low lands about San Francisco Bay.

Refs.—RUMEX OBTUSIFOLIUS L. Sp. Pl. 335 (1753), type European; Trel. Rep. Mo. Bot. Gard. 3: 91, pl. 30 (1892); Jepson, Fl. W. Mid. Cal. 157 (1901).

10. **R. persicarioides** L. GOLDEN DOCK. Stems soft and fistulous (at least below), prostrate or erect, seldom more than 1 foot high; herbage yellowish green, minutely pubescent; leaves oblong or lanceolate, truncate or subcordate at base, acute at apex, a little undulate, 2 to 4 inches long, rather short-petioled; flowering branches with scattered subequal leaves, the whorls mostly crowded or the lower remote; pedicels very unequal, tumidly jointed at base; inner fruiting sepals ¾ to 1½ lines long, acutely produced at apex with 2 or 3 awn-like teeth on each side; callous grains 3; fruit almost bur-like.

Wet places by lakes or streams or in marshy lands. California north to British Columbia, east to the Atlantic.

Locs.—Nigger Slough, Los Angeles Co., *Braunton* 1877; Castroville, *Abrams* 4979; Mountain Lake, San Francisco, *Jepson;* Alvarado, *Jepson;* Upper Lake, *Jepson;* Butte Valley, Siskiyou Co., *Butler* 1877.

Refs.—RUMEX PERSICARIOIDES L. Sp. Pl. 335 (1753), type loc. Virginia; Trel. Rep. Mo. Bot. Gard. 3: 93, pl. 32 (1892); Jepson, Fl. W. Mid. Cal. 158 (1901). *R. maritimus* Wats. Bot. Cal. 2: 9 (1880), not L.

11. **R. paucifolius** Nutt. Stems 9 to 15 inches high, in clusters from the crown of a taproot; leaves mostly basal, linear to narrowly ovate or oblong, entire, 1 to 3 inches long, drawn down to petioles 1 to 2 times as long; flowers on slender leafless branches; pedicels jointed toward the base; inner fruiting sepals round-cordate, finely reticulated, 1 to 1½ lines long, much longer than the achene.

Sierra Nevada, 3500 to 9500 feet. North to British Columbia and east to Colorado.

Locs.—Mt. Whitney, *Culbertson* 4371; Mt. Goddard, *Hall & Chandler* 661; Yosemite, *Lembert;* White Horse Lake, Modoc Co., *Baker & Nutting.*

Refs.—RUMEX PAUCIFOLIUS Nutt. Jour. Acad. Phila. 7: 49 (1834), type loc. Flathead River, Idaho, *Wyeth.* *R. geyeri* Trel. Rep. Mo. Bot. Gard. 3: 78, pl. 15 (1892).

12. **R. acetosella** L. SHEEP SORREL. Stems tufted, ½ to 2 feet high, arising from running rootstocks; lower leaves hastate, the upper reduced or the branches leafless and ending in the reddish (pistillate) or yellowish (staminate) panicle; pedicels as long or twice as long as the flowers, not jointed; staminate flowers 1 line long or less, the pistillate rather smaller; achene granular.

Naturalized weed; throughout the state, in places very common. The green leaves are very acid.

Refs.—RUMEX ACETOSELLA L. Sp. Pl. 338 (1753), type European; Trel. Rep. Mo. Bot. Gard. 3: 76, pl. 13 (1892); Davidson, Erythea, 1: 99 (1893); Jepson, Fl. W. Mid. Cal. 156 (1901).

3. OXYRIA Hill.

Alpine perennial herb. Leaves somewhat fleshy, round-reniform, long-petioled, mostly radical. Stems erect, bearing a panicle of small green perfect flowers. Calyx of 4 nearly distinct sepals, the 2 inner erect (appressed in fruit), the 2 outer spreading. Stamens 6. Stigmas 2. Achene thin and compressed, surrounded by a broad wing and thus orbicular in outline. One species. (Greek oxus, sour, on account of the acid leaves.)

1. **O. digyna** Hill. MOUNTAIN SORREL. Stems simple, scape-like, 3 to 11 inches high, several from a large chaffy rootstock; flowers on slender pedicels;

achene $1\frac{1}{2}$ lines in diameter, very much larger than the sepals, entire or emarginate at each end.

Alpine, among cold wet rocks, 8000 to 12,000 feet: Sierra Nevada, south to Mt. San Jacinto and north to Mt. Shasta. North to the Arctic Circle and around the northern hemisphere.

Locs.—Farewell Gap, *Jepson* 1019, 1143; Mt. Whitney, *Jepson* 1062; Kearsarge Pinnacles, *Jepson* 856; Mt. Goddard, *Hall & Chandler* 656; Mt. Dana, *H. M. Evans*; Conness Creek, Yosemite Park, *Jepson* 3362; Castle Peak, Nevada Co., *Heller* 7097; Mt. Bidwell, Modoc Co., *Manning* 349.

Refs.—OXYRIA DIGYNA Hill, Hort. Kew. 158 (1768); Merriam, N. Am. Fauna, 16: 144 (1899). *Rumex digynus* L. Sp. Pl. 337 (1753), type European.

4. **PTEROSTEGIA** F. & M.

Annuals with very slender and weak stems and opposite leaves. Flowers solitary and nearly sessile in the axils, longer than the subtending bract. Bract rounded and more or less 2-lobed, dentate on the margin, in fruit enlarged, scarious and reticulated, loosely enclosing the achene and developing 2 sac-like protuberances on the back. Calyx 6 (or 5) -parted; stamens as many or fewer than the lobes.—One species. (Greek pteron, a wing, and stege, a covering, in reference to the bract.)

1. **P. drymarioides** F. & M. Stems commonly several from the base, usually with a branch at each node, diffuse or straggling, a few inches to $1\frac{1}{4}$ feet long; leaves roundish or broader than long and notched once or twice at apex or even cleft, or distinctly fan-shaped or obcordate, 2 to 6 (or 10) lines broad, narrowed at base to a slender but mostly short petiole; flowers reddish, less than 1 line long; calyx-segments oblong-lanceolate.

Foothills, under trees in open woods, or in the shade of rock outcroppings, throughout California. North to Oregon, south to Lower California. Apr.-May.

Locs.—Morley's Sta., Shasta Co., *Baker & Nutting*; N. Tule River, *Purpus* 5686; Arbuckle, *Alice King*; Conn Valley, Napa Co., *Jepson*; Santa Maria, *Blochman*; Cañon Diablo, *Parish*; San Bernardino, *Jepson* 5527; Santa Monica, *Barber* 162; San Diego, *K. Brandegee.*

Refs.—PTEROSTEGIA DRYMARIOIDES F. & M. Ind. Sem. Hort. Petrop. 2: 48 (1835), type loc. Bodega; Jepson, Fl. W. Mid. Cal. 149 (1901).

5. **PHYLLOGONUM** Cov.

Prostrate annual with the leaves basal and in 3s at the nodes. Flowers yellow, pedicelled, borne in close fascicles at the nodes, without involucre or bracts. Calyx deeply cleft into 6 divisions. Stamens 9.—One species. (Greek phullon, leaf, and gonu, knee, on account of the leafy, not bracteate, nodes.)

1. **P. luteolum** Cov. Stems several from the base, 3 to 5 inches long with 3 to 5 branches at the nodes; herbage yellowish, nearly glabrous; leaves obovate, drawn down to a petiole; calyx $\frac{3}{4}$ to 1 line long.

Death Valley region. Collected only by Coville.

Refs.—PHYLLOGONUM LUTEOLUM Cov. Contrib. U. S. Nat. Herb. 4: 190 (1893), type loc. Furnace Creek Cañon, Funeral Mts., *Coville* 584. *Eriogonum luteolum* Jones, Contrib. 11: 15 (1903).

6. **NEMACAULIS** Nutt.

Annual with very slender stems and mostly basal white-woolly leaves. Flowers crowded in subglobose heads; heads sessile in the forks and along the branches, each flower subtended by an herbaceous bract. Calyx 6-cleft. Stamens 3. Achene short-ovoid.—One species. (Greek nema, thread, and kaulos, stem, referring to the slender stems.)

1. **N. denudata** Nutt. Stems prostrate or ascending, 6 to 14 inches long, glabrate, reddish; leaves spatulate, narrowed to a petiolar base, $\frac{1}{2}$ to $1\frac{1}{2}$ inches long, mostly basal with usually a few shorter ones in the axils of the lower bracts; bracts oblong, forming a whorl at the nodes; bracts of the flower-clusters obovate, 1 line long, glabrous below, white-woolly above, the

outer flowerless, the inner smaller; flowers yellowish, glabrous, $1\frac{1}{2}$ line long, pedicellate.

Sea-beaches, sand-dunes and sandy soils: Southern California from San Pedro to San Diego and the western edge of the Colorado Desert. Lower California.

Locs.—Long Beach, *Parish;* Del Mar, *Jepson* 1617; San Diego, *K. Brandegee;* Carrizo Creek, *Brandegee;* Palm Sprs., *Parish* 4140.

Refs.—NEMACAULIS DENUDATA Nutt. Jour. Acad. Phila. ser. 2, 1: 168 (1848), type loc. San Diego, *Nuttall. N. nuttallii* Benth. in DC. Prodr. 14: 23 (1856); Wats. Bot. Cal. 2: 16 (1880).

7. **HOLLISTERIA** S. Wats.

White-woolly annual herbs. Leaves alternate, cuspidate, with a small lanceolate pair at base like stipules. Involucres solitary and sessile in the axils, composed of 3 almost distinct linear bracts, 2-flowered. Flowers unequally pedicelled, with a minute scarious bractlet at base. Calyx 6-cleft to the middle. Stamens 5 to 9, included. Achene glabrous.—One species. (Col. W. W. Hollister, pioneer Californian.)

1. **H. lanata** Wats. Stems several or many from the base, prostrate, 3 to 7 inches long; basal and lowest stem leaves oblanceolate, narrowed to a petiole, 1 to $1\frac{3}{4}$ inches long, glabrate; stem leaves ovate, sessile, cuspidate, 3 to 7 lines long, white-woolly; calyx 1 line long, very woolly outside, its lanceolate lobes green with a scarious margin.

Southern Monterey Co. easterly to the upper San Joaquin Valley.

Locs.—Oil City, *Heller* 7741; Caliente Creek, *Davy* 1902; Sumner, *K. Brandegee.*

Refs.—HOLLISTERIA LANATA Wats. Proc. Am. Acad. 14: 296 (1879), type loc. Cholame Valley, Monterey Co., *Lemmon. Chorizanthe floccosa* Jones, Contrib. 12: 74 (1908), type loc. Bakersfield, *Jones.*

8. **LASTARRIAEA** Remy.

Small fragile annual, diffusely branched from the base. Leaves linear, in a basal tuft and in whorls along the stem, the upper ones and the bracts with hooked awns. Flowers solitary, sessile in the forks and terminal, concealed by the involucre-like whorl of bracts. Calyx simulating an involucre, tubular, 5 to 6-cleft, the teeth with hooked awns. Stamens 3, inserted on the throat, the filaments with a small membranous tooth on each side.—One species. (J. V. Lastarria, 1817-1888, Chilean publicist and writer.)

1. **L. chilensis** Remy. Stems 2 to 10 inches long; herbage slightly hairy; floral bracts crowding the ends of the branchlets, scattered below; calyx 1 to 2 lines long.

Naturalized from Chile. Dry sandy soil: Antioch southward to Kern and Monterey cos. and Southern California, thence north to Mono Co. Lower Cal. May-June.

Refs.—LASTARRIAEA CHILENSIS Remy, in C. Gay, Fl. Chil. 5: 290, t. 58 (1849), type loc. Chile; Jepson, Fl. W. Mid. Cal. 149 (1901). *Chorizanthe lastarriaea* Parry, Proc. Davenp. Acad. 4: 63 (1884); West Am. Sci. 1: 29 (1885).

9. **CHORIZANTHE** R. Br.

Low dichotomously branched annual herbs of summer. Leaves mostly in a basal rosette which disappears early in the dry season, the cauline leaves commonly reduced to opposite, ternate or unilateral bracts. Involucres commonly 1, sometimes 2 to 6-flowered, cylindric, urnshaped or triangular, always sessile, mostly 3 to 6-angled or -costate, 3 to 6-toothed or -cleft; teeth divaricate, cuspidate or awned, the awns commonly with a hooked tip. Flowers pedicelled or nearly sessile, without bractlets, included within the involucre or the calyx protruding. Calyx 6-parted or -cleft, colored, never herbaceous. Stamens usually 9, 6 or 3. Ovary glabrous.—Thirty Pacific Coast species in North America and 7 suffrutescent ones in Chile. Ours are of the deserts or arid foothills. The basal leaves are often different in color from the cauline leaves or foliaceous bracts, both in Oxytheca and Chorizanthe. This difference is the more striking when it is associated with form differences as is notably the case in Oxytheca perfoliata. (Greek chorizo, to divide, and anthos, flower, on account of the parted calyx.)

A. Bracts entire.

Involucres urn-shaped or the tube cylindric and slightly contracted below the teeth; teeth equal or the 3 alternate shorter, bordered by a scarious membrane; stamens 6 or 9, inserted at base or lower part of calyx-tube.
Involucre bordered by a broad membrane, the teeth excurrent from it.
Membrane white, the 6 involucral teeth equal..................1. *C. membranacea.*
Membrane purple, 3 of the involucral teeth usually inconspicuous or minute...... 2. *C. nortoni.*
Involucral teeth bordered by a narrow membrane but distinct.
Calyx-lobes bifid, erect; Sierra foothills..........................3. *C. stellulata.*
Calyx-lobes not bifid; Coast Ranges along the coast.
Mostly prostrate or diffuse; membrane of involucral lobes not continuous around sinuses ....4. *C. pungens.*
Erect; membrane of involucral lobes continuous around sinuses..5. *C. douglasii.*
Involucres not scarious margined.
Involucral tube cylindric, usually 6-ribbed; stamens 6 or 9, inserted at base or lower part of calyx-tube.
Plants erect.
Joints excessively fragile; calyx-lobes equal; plant yellowish..6. *C. brevicornu.*
Joints less fragile.
Calyx-lobes not fringed.
Calyx-lobes entire; plant reddish.
Calyx-lobes equal; rare ....7. *C. breweri.*
Calyx-lobes unequal; common ....8. *C. staticoides.*
Calyx-lobes erosulate, very unequal....................9. *C. valida.*
Calyx-lobes, at least the inner, fringed.
Lobes very unequal, the inner fringed...............10. *C. palmeri.*
Lobes equal, all fringed.................... ....11. *C. fimbriata.*
Plants prostrate or procumbently spreading.
Involucral teeth subequal or 3 long and 3 short; coastal area, Southern California.
Plants low, spreading horizontally; flowers white............12. *C. parryi.*
Plants procumbent; flowers yellow....................13. *C. procumbens.*
Involucral teeth very unequal.
Involucre 6-ribbed.
One tooth very long and 5 very short; stamens 6 or 9............ 14. *C. uniaristata.*
Teeth very unequal; stamens 3...................15. *C. clevelandii.*
Involucre 4 or 5-ribbed; stamens 9......................16. *C. spinosa.*
Involucral tube 3-angled, or cylindric but not ribbed or angled, in either case usually transversely corrugated; calyx tubular, shortly 6-cleft; stamens 6 or 9, inserted on its throat.
Involucral tube 3-angled; teeth stout, divergent.
Teeth equal or in equal sets.
Teeth 3; cauline leaves usually none...................17. *C. orcuttiana.*
Teeth 6, the alternate 3 very short and inconspicuous; cauline leaves in pairs ....18. *C. polygonoides.*
Teeth 3, very unequal, foliaceous, ovate to lanceolate; very spiny..19. *C. rigida.*
Involucral tube cylindric, not ribbed or angled.
Involucral lobes 3, equal, the tube strongly corrugated.......20. *C. corrugata.*
Involucral teeth or lobes 5, one foliaceous and much larger than the other 4, the tube obscurely corrugated..........................21. *C. watsonii.*

B. Bracts 3-lobed.

Involucre without spurs, sometimes the angles gibbous at base.
Involucres 4-angled, 4-toothed.
Bracts minute; involucral teeth equal.........................22. *C. vortriedei.*
Bracts very conspicuous and foliaceous, orbicular-perfoliate; teeth unequal........ 23. *C. perfoliata.*
Involucres cylindric, not 4-angled.
Involucral tube smooth, its teeth 4, unequal; bracts unilateral. 3-lobed, foliaceous and conspicuous..24. *C. californica.*

Involucral tube sulcate, its teeth 5, equal; bracts small............25. *C. insignis.*
Involucre with spurs at base.
Spurs 6, spine-like; involucral teeth uncinate........................26. *C. leptoceras.*
Spurs 3, saccate, each about as large as involucral tube; involucral teeth straight........
27. *C. thurberi.*

1. **C. membranacea** Benth. (Fig. 67a.) Erect, $\frac{1}{2}$ to $1\frac{1}{2}$ feet high, mostly simple below, once to thrice dichotomous above, the involucres in solitary capitate clusters along the branches or mostly terminal; herbage lanate, floccose in age, the upper surface of the leaves glabrate; leaves linear, sessile, or gradually narrowed into a short petiole, $\frac{1}{2}$ to $1\frac{1}{4}$ inches long; involucres urnshaped, $1\frac{1}{2}$ to 2 lines long, wholly white-scarious between the awned teeth, or some involucres, especially solitary ones in the lower forks, wholly destitute of membranous border; awns slender, uncinate, and strongly divergent; flowers 2 or 3, unequally pedicelled, of these 1 or 2 undeveloped or obsolete; calyx woolly, its segments obovate or spatulate, the inner narrower, all clawed, united only at very base; stamens 9.

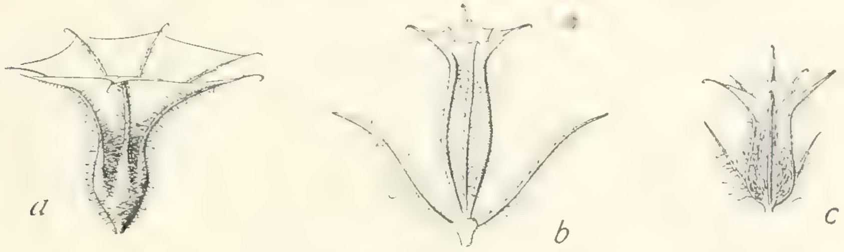

Fig. 67. Involucres of CHORIZANTHE. *a*, C. MEMBRANACEA Benth.; *b*, C. NORTONI Greene; *c*, C. PUNGENS Benth. x 5.

Coast Ranges, mostly towards the interior from Tehama Co. south to the Santa Inez Mts.; Sierra Nevada, in the foothills and lower part of the Yellow Pine belt. May-June.

Locs.—Salt Creek, Tehama Co., *Jepson;* Scotts Valley, Lake Co., *Tracy* 1657; Napa Range, *Jepson;* Vacaville, *Platt;* Mt. Diablo, *Jepson;* Crystal Springs, San Mateo Co., *Bolander;* Mt. Day, Santa Clara Co., *R. J. Smith;* Big Sur River, *Davy* 7435; San Antonio Trail, Santa Lucia Mts., *Jepson* 1665; Estrella, *Jared;* Santa Inez Mts., *Dunn;* Old Colony Mill, *K Brandegee, Jepson* 633; Toll House, Fresno Co., *Hall & Chandler* 31; Yosemite, *R. J. Smith;* Bowers Cave to Hazel Green, *Jepson;* Sheep Ranch, Calaveras Co., *Davy* 1610.

Refs.—CHORIZANTHE MEMBRANACEA Benth. Trans. Linn. Soc. 17: 419, t. 17, fig. 11 (1837), type from California, *Douglas;* Jepson, Fl. W. Mid. Cal. ed. 2, 129 (1911).

2. **C. nortoni** Greene. (Fig. 67b.) Mostly 1-stemmed, 2 or 3-forked, or sometimes many-stemmed from base, 4 to 7 inches high, the involucres congested in terminal heads; leaves oblanceolate, 1 to $1\frac{3}{4}$ inches long; lower bracts foliaceous, the upper reduced; herbage hairy; involucres reddish, cylindric-urnshaped, 6-ribbed, margined by a broad scarious purple 6-lobed border; lobes unequal, the 3 larger triangular in outline, the 3 alternate often small or obsolete, all ending in a short uncinate awn; some earlier involucres solitary in the forks and these destitute of scarious margin; calyx rose-color, little exserted, its short oblong lobes equal, undulate-erosulate; stamens 6.

Mountains bounding the Salinas Valley and westward to the Pacific Ocean. June. Involucres often reticulate between the ribs.

Locs.—Big Sur, *Davy* 1431; Santa Lucia Creek, *Jepson* 4732; Burro Trail, Santa Lucia Mts., *K. Brandegee;* Bitterwater, *Eastwood;* Estrella, *Jared.*

Ref.—CHORIZANTHE NORTONI Greene, Pitt. 2: 164 (1891), type loc. Gonzales, *A. Norton.*

3. **C. stellulata** Benth. Stem erect, trichotomously branched, mostly above the base, 4 to 6 inches high, the involucres in cymose clusters or somewhat capitate; herbage hairy; leaves linear, acute, sessile, 5 to 8 lines long, in a rosette

at base and in whorls at the nodes or reduced above; involucres cylindric-urnshaped, 6-ribbed, 2 lines long, reticulate between the ribs; involucral teeth 6, nearly equal, with scarious margins, the tips uncinate or straight; calyx-lobes bifid or usually so.

Sierra Nevada foothills.

Locs.—Clover Creek Falls, Shasta Co., *M. S. Baker* 460; Chico, *Parry;* Sweetwater Creek, El Dorado Co., *K. Brandegee;* Merced Co. foothills, *Buckminister;* Raymond, *Congdon;* Toll House, Fresno Co., *Hall & Chandler* 30.

Ref.—CHORIZANTHE STELLULATA Benth. in DC. Prodr. 14: 26 (1856), type loc. east side of the upper Sacramento Valley, *Hartweg* 1937.

4. **C. pungens** Benth. (Fig. 67c.) Stems prostrate or at first erect, more or less dichotomous, 2 to 15 inches long, the involucres in head-like clusters on very short lateral branchlets or terminal; herbage villous pubescent; leaves basal and in pairs at the lower nodes, spatulate or oblanceolate, narrowed to a petiole, ½ to 2 (or 4) inches long, reduced above to bracts; involucres cylindric-urnshaped, hairy, 1 to 1½ lines long, subtended by subulate or acicular pungent bracts; involucral tube sharply 6-angled or -ribbed, unequally 6-toothed, the alternate teeth shorter, all uncinate and more or less scarious-margined towards the base; calyx white, its lobes equal, oblong, erose-denticulate, hairy on the outside; stamens 9 or 6.

Sand-dunes and sandy valleys along the coast from Marin Co. south to Santa Barbara Co.

Locs.—San Francisco, *Jepson;* Rockspur, Monterey Co., *K. Brandegee;* Seaside, *Heller* 6749; Pacific Grove, *Jepson;* Surf, *K. Brandegee.*

Var. **diffusa** Parry. Leaves all basal; scarious border of the involucral teeth pink.—Valleys, Santa Cruz to Monterey.

Var. **nivea** Curran. All the involucral teeth with scarious white margins, the alternate teeth smaller; calyx yellow, its lobes with white margin.—Mountains near San Luis Obispo; Seaside, *F. G. Woodcock.*

Var. **cuspidata** Parry. Involucral teeth without scarious margins or the margins scant, otherwise identical with the species.—San Francisco (*Davy* 1172) north to Dillon's Beach (*M. S. Baker*).

Var. **robusta** Jepson n. comb. Stems erect, branched above, ½ to 2 feet high; heads large, dense, mostly terminal or subterminal; involucral teeth with narrow margins or none.—Bay region south to Monterey Bay: Alameda, *Jepson;* Colma, *K. Brandegee;* Aptos, *Parry.*

Refs.—CHORIZANTHE PUNGENS Benth. Trans. Linn. Soc. 17: 419, t. 19, fig. 2 (1837), type from California, *Douglas;* Jepson, Fl. W. Mid. Cal. 151 (1901). *C. andersonii* Parry, Proc. Davenp. Acad. 5: 175 (1889), type loc. Scotts Valley near Santa Cruz, *Anderson. C. douglasii* Parry, l. c. Var. DIFFUSA Parry, l. c. 4: 60 (1884). *C. diffusa* Benth. in DC. Prodr. 14: 26 (1856), type loc. Monterey, *Hartweg* 1938. Var. NIVEA Curran, Bull. Cal. Acad. 1: 274 (1885), type loc. mountains near San Luis Obispo. Var. CUSPIDATA Parry, Proc. Davenp. Acad. 4: 60 (1884). *C. cuspidata* Wats. Proc. Am. Acad. 17: 379 (1882), type loc. San Francisco, *M. E. Jones* 2386. *C. villosa* Eastw. Bull. Torr. Club, 30: 485 (1903), type loc. Bodega Pt., *Eastwood.* Var. ROBUSTA Jepson. *C. robusta* Parry, Proc. Davenp. Acad. 5: 176 (1889), type spms. from Aptos, *Parry,* and Alameda, *Greene;* Jepson, Fl. W. Mid. Cal. ed. 2, 129 (1911).

5. **C. douglasii** Benth. Stem erect, tri- or di-chotomously branching, 4 to 6 inches high; basal leaves spatulate, shortly petioled, the cauline oblong to linear; bracts subulate; herbage somewhat hairy pubescent; involucres hairy, condensed in terminal heads, urnshaped-cylindric, 1½ lines long, sharply ribbed, reticulate between the ribs; involucral teeth spreading, membranous margined below the short hooked awn, the membrane continuous in the sinus between the teeth; calyx rather deeply cleft, its lobes equal, oblong-ovate, obtuse, erosulate.

Monterey Co.

Locs. No exact station known. We maintain this as a species with misgivings but refer here with considerable certainty a collection made in Monterey Co. by Mrs. Mary S. Clemens in 1907 (Herb. Pac. Grove Mus.). This material is scanty but seems distinct (as is too often the case when one is dealing with single sheets instead of ample series of specimens) from any of the forms referred to C. pungens. C. douglasii has long remained obscure and has rarely been honored with the citation of definite material. Dr. Parry accepted and described it as a species (Proc. Davenp. Acad. 5: 175), citing as typical his specimens from the valleys back of Santa Cruz near Felton and Ben Lomond. These plants have purple membranes to the involucral teeth as described for the type, but we should, however, not regard them as specifically distinct from C. pungens.

Ref.—CHORIZANTHE DOUGLASII Benth. Trans. Linn. Soc. 17: 418 (1837), type from California (probably Monterey Co.), *Douglas*.

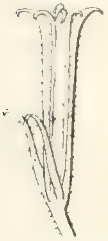

Fig. 68. CHORIZANTHE BREVICORNU Torr.; involucre, x 5.

6. **C. brevicornu** Torr. (Fig. 68.) Stems several from the base, erect, repeatedly and shortly dichotomous, yellowish, 3 to 8 inches high, excessively fragile; herbage minutely pubescent; leaves in a basal tuft, linear-oblanceolate, narrowed to a petiole, ½ to 2 inches long; involucres in the forks and along the branchlets, 1-flowered, cylindric, 2 to 2½ lines long, acutely 3-angled or 3-ribbed, with 3 smaller ribs between, minutely corrugated between the ribs; teeth 6, hooked, the 3 alternate smaller; flowers white, glabrous, sessile; calyx-tube long and slender, its lobes oblong, nearly equal, truncatish and erosulate at apex, barely exserted; stamens 3, at base.

Arid stony hills, Colorado and Mohave deserts north to Inyo Co. Nevada, Arizona. More fragile than any other species, the specimens usually disjointing completely when dry.

Locs.—Bishop Creek, *Hall & Chandler* 7262; Argus Mts., *Purpus* 5318; Barstow, *Jepson* 5377; Sheephole Mts., *Hall* 6056; Borego Spr., *Brandegee*; Pinto Mts., *Hall* 6029; Palm Cañon, Mt. San Jacinto, *Jepson* 1389; San Felipe Creek, *Brandegee*.

Ref.—CHORIZANTHE BREVICORNU Torr. Bot. Mex. Bound. 177 (1859), type loc. Gila River, *Parry*.

7. **C. breweri** Wats. Similar to C. staticoides but more diffuse; herbage canescent but reddish; involucres acutely 6-ribbed and reticulated, constricted a little below the spreading teeth, the alternate teeth somewhat smaller; calyx white, exserted, its lobes oblong to elliptic, obtuse, entire, subequal, at least when fully developed.

Hillsides at Chorro near San Luis Obispo, *K. Brandegee*. Insufficiently known and perhaps only a variety of the next.

Ref.—CHORIZANTHE BREWERI Wats. Proc. Am. Acad. 12: 270 (1877), type spms. from San Luis Obispo, *Brewer* 461, and Santa Margarita Valley, *Brewer* 501. No. 501 has scariously margined involucres; otherwise it appears to be the same as no. 461. The type specimens are young. The following description is taken wholly from a duplicate specimen of the type no. 461. Diffuse, 3 or 4 inches high, somewhat canescent; leaves round-ovate, 4 to 6 lines long, abruptly drawn down to a petiole as long; involucres in terminal clusters on the branchlets, cylindric, 6-ribbed, 6-toothed, the 3 alternate teeth smaller; flowers whitish, very shortly pedicelled, included; calyx cleft over half-way, the outer lobes elliptic, the inner oblong, shorter, all the lobes entire.

8. **C. staticoides** Benth. Stems 1 or several from the base, erect or ascending, cymosely dichotomous, 4 to 10 (or 18) inches high, fragile at the joints, the sessile involucres solitary in the forks or congested at the end of the branchlets; herbage characteristically reddish, soft-pubescent, the under surface of the leaves white-woolly; leaves obovate to elliptic, 3 to 9 lines long, the petioles 1 to 3 times as long; involucres cylindric, 6-ribbed, 2 to 2½ lines long, the teeth spreading, hooked at tip, 3 much larger than the 3 alternate or the latter obsolete; calyx white, rose-pink or deep rose, exserted, the lobes narrowly oblong, mostly entire, hairy on the back, the inner smaller and shorter; stamens 9 or 6.

Dry sandy plains: Southern California in the coastal region, north to Monterey Co. and east to the foothills and the floor of the upper San Joaquin Valley. Not known in the Mohave or Colorado deserts.

Locs.—Descanso, *K. Brandegee;* Witch Creek, *Alderson;* Coahuilla Valley, *Jepson* 1479; San Jacinto Valley, *Reinhardt;* Elysian Park, Los Angeles, *Braunton* 418; Riverside, *Wilder;* San Bernardino, *Parish, Jepson* 5565; McKittrick, *Heller* 7797; San Emigdio Cañon, *Davy* 1974; Alcalde, *Brandegee;* Pacific Valley, *Eastwood;* Rancho San Miguelito, Jolon, *Jepson* 1623; Atascadero, *Brewer* 894; Arroyo Grande, *King;* Bakersfield, *Davy* 1882; Greenhorn Mts., *Hall & Babcock* 5081; N. Fork Kaweah, *Jepson* 564.

Var. **nudicaule** Jepson n. comb. Herbage commonly greenish; flowers white. —Mountain slopes along the coast from Santa Barbara to Echo Mt.

Refs.—CHORIZANTHE STATICOIDES Benth. Trans. Linn. Soc. 17: 418 (1837), type from California, *Douglas. C. xanti* Wats. Proc. Am. Acad. 12: 272 (1877), at least as to the type spms. from Fort Tejon, being the one first cited. Var. NUDICAULE Jepson. *C. nudicaule* Nutt. Jour. Acad. Phila. ser. 2, 1: 166 (1847), type loc. Santa Barbara, *Nuttall. C. wheeleri* Wats. l. c., type loc. Santa Barbara, *Rothrock*, which is clearly the equivalent of *C. nudicaule* Nutt.

9. **C. valida** Wats. Erect, 4 to 6 inches high, once or twice di- or tri-chotomously branched; leaves spatulate; involucral teeth or lobes not margined but awned; awns mostly straight; inflorescence similar to the preceding; flowers pedicellate, partly exserted; calyx-segments oblong, erose-denticulate, hirsute along the back on the midvein, very unequal (the alternate only ½ as long).

Sonoma; Petaluma; Russian River. Rarely collected and little known. Perhaps only a variety of C. pungens.

Refs.—CHORIZANTHE VALIDA Wats. Proc. Am. Acad. 12: 271 (1877), type specimens from Sonoma Co.; Jepson, Fl. W. Mid. Cal. ed. 2, 129 (1911).

10. **C. palmeri** Wats. Stem erect, trichotomous, 5 to 12 inches high, the ends of the simple or dichotomous branches bearing head-like clusters of erect compactly crowded involucres, the forks usually with solitary involucres; herbage hairy pubescent; leaves in a basal tuft, oblong-spatulate, ½ to 1¼ inches long; bracts of the flower clusters setaceous; involucres cylindric or a little contracted upward, 1½ to 2 lines long, 6-ribbed, 6-toothed, the larger 3 unequal, the smaller 3 nearly equal, all tipped with mostly straight spines; flowers rose-color, exserted, very shortly pedicelled; calyx shortly cleft, the outer lobes roundish, entire, the inner shorter, truncate or bifid, shortly laciniate-fringed; stamens 9.

Dry hills, Monterey and San Luis Obispo cos.

Locs.—Jolon, *K. Brandegee;* San Miguelito Rancho, *Jepson;* Nacimiento River, *Davy;* San Simeon, *K. Brandegee;* San Luis Obispo, *K. Brandegee;* Creston, *Barber;* Santa Maria, *Blochman.*

Ref.—CHORIZANTHE PALMERI Wats. Proc. Am. Acad. 12: 271 (1877), type loc. San Luis Obispo, *Palmer* 464.

11. **C. fimbriata** Nutt. Stem erect or diffuse, trichotomous at first node, then dichotomously branching, 4 to 10 (or 15) inches high, the involucres solitary in the forks or clustered along the terminal branchlets; herbage reddish, lightly pubescent; leaves basal, spatulate or obovate, narrowed to a petiole, 1 to 2 inches long; bracts subulate or acicular; involucres cylindrical, 2 to 3 lines long, 6-ribbed, ending in 6 spreading spine-tipped teeth, the alternate teeth smaller; teeth uncinate (or straight); calyx white, exserted, its lobes ovate-lanceolate, equal, irregularly fringed on each side, mostly below the middle; stamens 6.

San Diego Co. May-July.

Locs.—San Diego, *Brandegee, Chandler, Jepson* 1591; Spring Valley, *Hall* 3892; Pala, *Parish* 4399.

Var. **laciniata** Jepson n. comb. Habit, foliage, involucres and pubescence that of the species; calyx rose-color, its lobes laciniate-fringed throughout.—San Diego Co.

Locs.—Witch Creek, *Alderson;* Cuyamaca, *K. Brandegee;* Descanso, *K. Brandegee;* Palomar, *Jepson* 1516. Also in Lower Cal.

Refs.—CHORIZANTHE FIMBRIATA Nutt. in Jour. Acad. Phila. ser. 2, 1: 168 (1847), type loc. San Diego, *Nuttall;* Torr. Pac. R. Rep. 5^2: 364, t. 8 (1857). Var. LACINIATA Jepson. *C. laciniata* Torr. Pac. R. Rep. 7^2: 19 (1856), type loc. San Felipe, *Thos. Antisell.*

12. **C. parryi** Wats. Stems several from the base, spreading horizontally and repeatedly forking, forming low flat-topped plants 3 to 15 inches broad, the involucres clustered at the ends of the branchlets; leaves oblong, narrowed to a short petiole, 4 to 9 lines long; involucres 1 line long, cylindric but somewhat contracted below the spreading teeth, the tube acutely 6-angled; teeth uncinate, 3 large alternating with 3 small; calyx white, its segments erosulate, the inner half as large as the outer; stamens 9.

Sandy or gravelly plains, San Bernardino Valley.

Locs.—Lugonia, *Parish;* West Riverside, *Hall;* San Bernardino, *Parish* 3674, *Jepson* 5523; Redlands, *Jepson* 5537; Colton, *Cleveland.*

Refs.—CHORIZANTHE PARRYI Wats. Proc. Am. Acad. 12: 271 (1877), type loc. Crofton, *Parry.* *C. fernandina* Wats. Bot. Cal. 2: 481 (1880), type loc. San Fernando Cañon, Los Angeles Co., *Mrs. A. E. Bush;* awns of the involucre, or some of them, straight; calyx-lobes nearly equal, the alternate narrower.

13. **C. procumbens** Nutt. Stems procumbent, several from the base, elongated and sparingly branched, 3 to 13 inches long, the involucres in small clusters along and towards the ends of the branchlets; herbage soft-pubescent; leaves spatulate or oblanceolate, in a basal tuft and at the lower nodes; bracts lanceolate; involucres 6-ribbed, with mostly 6 equal spreading teeth, or the 3 alternate shorter; calyx yellow, the inner lobes much smaller than the outer.

Southern California in the coastal region.

Locs.—Point Loma, San Diego, *K. Brandegee;* Elsinore, *McClatchie* 49; Witch Creek, *Alderson;* Palomar, *Jepson* 1557, *Hall* 1983; San Bernardino, *Parish* 3663.

Ref.—CHORIZANTHE PROCUMBENS Nutt. in Jour. Acad. Phila. ser. 2, 1: 167 (1847), type loc. San Diego, *Nuttall.*

14. **C. uniaristata** T. & G. Stems prostrate, 2 to 6 inches long, with a short soft pubescence; leaves broadly spatulate, the bracts oblanceolate and cuspidate or nearly acicular towards ends of branches; involucres numerous and rather loosely cymose on the branches or sometimes densely clustered, cylindric-urnshaped, 6-ribbed, 1½ to 2 lines long; involucral teeth awned, one awn long and straight, the others very short and hooked; flowers cream-color; outer calyx-lobes obovate, entire, the inner half as long, oblong, crenate; stamens 6 or 9.

Mt. Diablo and through the South Coast Ranges to San Luis Obispo Co., thence east to the Sierra Nevada in Kern Co.

Locs.—Jolon, *K. Brandegee;* Estrella, *Jared;* Havilah, Kern Co., *K. Brandegee;* Walker Basin, *Coville.*

Refs.—CHORIZANTHE UNIARISTATA T. & G. Proc. Am. Acad. 8: 195 (1870), type loc. New Idria, *Brewer;* Jepson, Fl. W. Mid. Cal. 151 (1901).

15. **C. clevelandii** Parry. Stems prostrate, branched from the base, 4 to 10 inches long; herbage hairy pubescent; basal leaves ovate-spatulate, cauline leaves narrow and pungent; involucre 6-ribbed, with unequal divergent uncinate teeth; outer calyx-lobes broadly oblong, truncate, erosulate or denticulate, the inner about half as long as the outer; stamens 3.

Region of Clear Lake. Closely allied to C. uniaristata.

Locs.—Mt. Hanna, *Jepson;* Kelsey, *K. Brandegee;* Mt. Konocti, *Jepson;* Grizzly Cañon, *K. Brandegee;* Scotts Valley, *Tracy* 1740; Eel River, *Purpus* 1245.

Refs.—CHORIZANTHE CLEVELANDII Parry, Proc. Davenp. Acad. 4: 62 (1884), type loc. Allen's Sprs., Lake Co., *D. Cleveland;* Jepson, Fl. W. Mid. Cal. 151 (1901).

16. **C. spinosa** Wats. Stems several from the base, prostrate, forming a loose spiny mat 8 to 16 inches broad; herbage puberulent; basal leaves oval or obovate, narrowed to a petiole with a broad or clasping base; bracts lanceolate, setaceous, conspicuous, their axils bearing clusters of 3 or 4 involucres; involucres short-cylindric, 4 or 5-costate, the teeth very unequal, usually with 1 long tooth, 1 or 2 minute ones and 1 or 2 of intermediate size, all straight-awned; flowers 2 or 3, pedicelled, usually only 1 developed; calyx white, the 3

outer lobes orbicular with a short narrow claw, the 3 inner ovate, smaller, minute; stamens 9.

Mohave Desert: Muroc (Yucca), *K. Brandegee.* A very distinct species.

Refs.—CHORIZANTHE SPINOSA Wats. Bot. Cal. 2: 481 (1880), type loc. Mohave Desert, *Lemmon,* not "San Bernardino"; Parish, Zoe, 5: 113 (1901).

17. **C. orcuttiana** Parry. Stems several from the base, prostrate, 1 to 4 inches long, sparingly dichotomous; herbage thinly pubescent; leaves spatulate or narrowly oblanceolate, mostly in a basal tuft; involucres scattered along the branches and terminal; involucral tube nearly 1 line long, cylindric but 3-angled, 3-toothed, not or only obscurely reticulated, its stout teeth nearly or quite horizontally spreading and as long as the tube; flowers usually 1, pedicelled; "calyx-lobes equal, its tube narrowly turbinate; stamens 9 or fewer."

Point Loma, San Diego (only known station). Quite like C. polygonoides in habit but its involucres very different.

Ref.—CHORIZANTHE ORCUTTIANA Parry, Proc. Davenp. Acad. 4: 54 (1884), type loc. San Diego, *Orcutt.*

18. **C. polygonoides** T. & G. Dichotomously branched, forming mats 5 to 10 inches across; basal leaves oblanceolate, contracted to a petiole, 3/4 to 1 1/2 inches long; bracts in pairs, oblanceolate or obovate, resembling the leaves of the basal rosette and becoming smaller towards the ends of the branches; involucres obpyramidal, strongly 3-angled, corrugated between the ribs, without scarious margin, solitary or in 2s or 3s, the tube 1 to 1 1/2 lines long, the 3 larger lobes as long and with alternating short and inconspicuous ones at base.

Central Coast Ranges; northern Sierra Nevada foothills; San Diego Co. The floristic distribution seems erratic, and the range is therefore, in all probability, insufficiently known.

Locs.—Big Valley, Modoc Co., *Baker & Nutting;* Scotts Valley, Lake Co., *Tracy* 1724; Howell Mt., *Tracy* 1564; Tamalpais, *K. Brandegee;* Oakland Hills, *K. Brandegee;* Sheep Ranch, Calaveras Co., *Davy* 1612; San Diego, *Brandegee.*

Refs.—CHORIZANTHE POLYGONOIDES T. & G. Proc. Am. Acad. 8: 197 (1870), type loc. Placerville, *Volney Rattan;* Jepson, Fl. W. Mid. Cal. ed. 2, 130 (1911).

19. **C. rigida** T. & G. Stem erect, 1 to 3 inches high, simple or very shortly branched, densely packed with short involucre-bearing branchlets, or sometimes diffusely spreading and forming a spiny mat 6 to 11 inches broad; leaves on the primary stem or branches round-ovate to obovate, 4 to 12 lines long, on petioles 1 to 1 1/2 times as long, those of the branchlets lanceolate or subulate, spine-tipped, becoming hard and rigid, the involucres in clusters in their axils; involucral tube short, about 1 line long and as broad, strongly and acutely 3-angled and strongly reticulated between the angles, its lobes 3, foliaceous, ovate to lanceolate, spreading, unequal, very unequal also on different involucres on the same plant, 3-ribbed and reticulate on back, 1 to 8 lines long, tipped with straight short spines; flower pedicelled, yellowish; calyx-tube narrow, abruptly expanded into the short throat and limb, its lobes oblong, short, very hairy on back, scarcely exserted; stamens 9, inserted at throat.

Colorado Desert and the eastern Mohave north to Inyo Co. Southern Nevada; Arizona. Lower California. Apr.-May. One of the most characteristic annuals on the driest stony hills where there is little or no other vegetation.

Locs.—Keeler, *Brandegee;* Argus Mts., *Hall & Chandler* 6897; Ludlow, *Hall* 6109; Calico Wash, *Jepson* 5388, 5409; Barstow, *Jepson* 4792 (plants prostrate forming a spiny mat); Chuckawalla Spr., *Hall* 5906; Borego Spr., *Brandegee.*

Refs.—CHORIZANTHE RIGIDA T. & G. Proc. Am. Acad. 8: 198 (1870). *Acanthogonum rigidum* Torr. Pac. R. Rep. 4^6: 133 (1857), type loc. Williams River, Ariz., *Bigelow.*

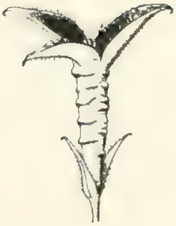

Fig. 69. CHORIZANTHE CORRUGATA T. & G.; involucre, x 6.

20. **C. corrugata** T. & G. (Fig. 69.) Stems several from the base, erect or ascending, 1 to 4 inches high, slightly villous; leaves roundish ovate, woolly or glabrate above, 2 to 9 lines long, on slender petioles; bracts subulate, small; involucres solitary in the forks and along the branches but numerous; involucral tube cylindrical, not angled or ridged but strongly corrugated, 1 to 1½ lines long; involucral lobes 3, equal, ovate, as long as the tube, woolly above, reticulate below, short-awned, uncinate; calyx white, included; "stamens 6 or 9, on middle of tube."

Eastern Mohave Desert and southward along the Colorado River to the Colorado Desert and Lower California.

Locs.—Amboy, *K. Brandegee;* Ludlow, *Jepson* 5503, 5507; Chuckawalla Spr., *Hall* 5905; Coachella, *Greata;* Santa Maria Mts., *Schellenger;* Signal Mt., *Brandegee.*

Refs.—CHORIZANTHE CORRUGATA T. & G. Proc. Am. Acad. 8: 198 (1870). *Acanthogonum corrugatum* Torr. Pac. R. Rep. 5^2: 364 (1857), type loc. Ft. Yuma.

21. **C. watsonii** T. & G. Stems erect or ascending, several from the base, dichotomous, 1 to 4 inches high; herbage canescent; leaves basal, narrowly oblanceolate; bracts in pairs, at length setaceous; involucres solitary in the forks and clustered towards the ends of the branchlets, canescent; involucral tube slender cylindric, not ribbed, obscurely corrugated, 2 to 3 lines long, its teeth 5, one foliaceous and usually much larger than the other four, especially on involucres solitary in the forks; flower pedicelled, included; calyx yellow, hairy externally; stamens 9, inserted at mouth of tube.

Eastern Mohave Desert, north to Inyo and Lassen cos. Nevada to Washington. Foliaceous lobe of the involucre 3 to 4 lines long.

Locs.—Lancaster, *Davidson;* Victor, *Hall* 6213; Barstow, *K. Brandegee;* Mt. Pinos, *Hall* 6355; Kernville and Lone Pine, *Brandegee;* Bishop Creek, *Hall & Chandler* 7247; Honey Lake, *Brandegee.*

Refs.—CHORIZANTHE WATSONII T. & G. Proc. Am. Acad. 8: 199 (1870), type specimens from Humboldt, Reese River and Grass valleys, Nev.; Wats., Bot. King, 313, pl. 34, figs. 4-6 (1871).

22. **C. vortriedei** Brandegee. Stem divaricately trichotomous at the first node, then dichotomous, 4 to 7 inches long, the internodes relatively long and the involucres solitary in the forks; herbage glabrous or a little glandular; leaves in a basal rosette, spatulate, ¼ to 1 inch long; bracts small, perfoliate, 3 (or 4)-lobed, the lobes triangular or oblong; involucres 1½ lines long, the tube 4-sided or 4-angled, the angles at base somewhat gibbous or ridge-like; involucral teeth 4, short, ovate or triangular, cuspidate; flowers 2, long-pedicelled; calyx yellowish-green, 5-cleft, each short yellowish division bearing two white oblong lobes; stamens 9, inserted at base; seed black, globose, apiculate.

Local species of the southern Santa Lucia Mts. In aspect suggestive of being a starved form of C. perfoliata, and yet a very distinctive species, particularly in its peculiar calyx.

Ref.—CHORIZANTHE VORTRIEDEI Brandegee, Zoe, 4: 158 (1893), type loc. Santa Lucia Mts., *Vortriede, Eastwood.* Also collected on the Burro Trail, *K. Brandegee.*

23. **C. perfoliata** Gray. Stem branching at or near the base, diffuse with numerous branchlets, 8 to 13 inches high; leaves spatulate, 1 to 2 inches long; herbage sparingly pubescent or a little glandular; bracts perfoliate, orbicular or 3-lobed, spine-tipped at the angles; involucres strongly and acutely 4-angled, 2 or in age 3 or 4 lines long, mostly one at each node, wrinkled between the ribs, the 4 divergent teeth spine-tipped; angles or ribs sometimes swollen into a small gibbous projection at base; calyx pedicelled; stamens 6.

Inner South Coast Range from western Stanislaus Co. to the head of the San Joaquin Valley and the central Mohave Desert. In habit remarkably similar to C. californica.

Locs.—Puerto Cañon, Stanislaus Co., *Brewer* 1261; San Carlos Range, *Jepson* 2737; Estrella, *Jared;* Bakersfield, *Davy* 1884; Tehachapi, *K. Brandegee;* Kramer, *K. Brandegee.*

Ref.—CHORIZANTHE PERFOLIATA Gray, Proc. Bost. Soc. Nat. Hist. 7: 148 (1861), type loc. Ft. Tejon, *Xantus.*

24. **C. californica** Gray. Stem branching at or near the base, rather sparingly forked into slender spreading branches, 4 to 14 inches high; herbage glandular hirsute; basal leaves ovate or broadly oblanceolate, narrowed to a short petiole, ¾ to 1¼ inches long; bracts broader than long, divergently 3-lobed, the lobes spine-tipped, 4 to 8 lines long; involucres in 3s at each node, 1-flowered, 1½ to 2 lines long, subcylindric, not ribbed, smooth, with stout spreading spine-tipped teeth; teeth mostly 3, unequal, sometimes with 4 in 2 unequal pairs or only 2; calyx white, the tube slender, a little exserted in anthesis, its lobes broadly oblong, very obtuse.

San Luis Obispo Co. to San Diego Co., mainly near the coast.

Locs.—Arroyo Grande, *Alice King;* Santa Maria, *Blochman;* Surf, *K. Brandegee* (a singular form with somewhat angular and urceolate involucral tubes and very large bracts); Santa Barbara, *M. S. Baker;* Los Angeles River, *Braunton* 417; San Bernardino, *Jepson* 5522; Playa del Rey, *Natho;* San Diego, *T. Brandegee.*

Refs.—CHORIZANTHE CALIFORNICA Gray, Proc. Bost. Soc. Nat. Hist. 7: 149 (1861). *Mucronea californica* Benth. Trans. Linn. Soc. 17: 419, t. 20 (1837), type from California, *Douglas.*

25. **C. insignis** Curran. Stem erect, divergently dichotomous, glandular, reddish, 3 to 4 inches high, the involucres solitary and secund along the branches; leaves in a basal tuft, linear-spatulate, glabrous, 3 to 6 lines long; bracts 3-lobed, the lobes oblong, those of the upper ones lanceolate-setaceous; involucres cylindric or obconic, slightly corrugate, lightly 5-sulcate, 1½ lines long, armed with 5 horizontally divergent spines; spines equal, straight, as long as the involucral tube; flowers 4 to 6 in each involucre, pedicelled; calyx rose-color, hairy, exserted; "stamens 9."

Central Monterey Co.: Jolon; Indian Valley. A delicate and interesting species. Notwithstanding its spurless involucre it is very nearly allied to C. leptoceras. The discovery of this species obviously binds C. leptoceras more closely to the generic type of Chorizanthe.

Ref.—CHORIZANTHE INSIGNIS Curran, Bull. Cal. Acad. 1: 275 (1885), type loc. Indian Valley near the Salinas River.

26. **C. leptoceras** Wats. (Fig. 70a.) Stems 2 or 3 from the base, very slender, divaricately dichotomous, 3 to 11 inches long; herbage glabrous except a little pubescence on the bracts and involucres; leaves basal, oblanceolate, ½ to 1 inch long; bracts 3-lobed, 1½ to 2½ lines broad; involucres in capitate clusters in the forks and terminal on the branchlets, the proper tube short, soon flaring into 6 lanceolate long-awned ciliate teeth and armed at base with 6 uncinate spine-like spurs; flowers 2 or 3; calyx campanulate, its spatulate lobes almost distinct; stamens 6.

Dry sandy plains at the southerly bases of the San Gabriel and San Bernardino mountains.

Locs.—Newhall acc. *Davidson;* Highland, *Parish;* San Bernardino, *Parish* 3646.

Refs.—CHORIZANTHE LEPTOCERAS Wats. Proc. Am. Acad. 12: 269 (1877). *Centrostegia leptoceras* Gray; T. & G. Proc. Am. Acad. 8: 192 (1870), type loc. San Gabriel, *Lobb.*

27. **C. thurberi** Wats. (Fig. 70b.) Stems 1 or several from the base, di- or tri-chotomously forking, 2 to 8 inches high; herbage glandular-hispidulose near the base, sparingly so above; leaves in a basal rosette, elliptic to oblong, 3 to 4 lines long; bracts small, 3-lobed and spine-tipped; involucres chartaceous, 2-flowered, solitary in the axils of the bracts, 2 lines long, cylindric, 5-toothed

and 3-horned; teeth erect, tipped with a short straight spine; horns near base saccate, spreading, short, thick, each tipped with a short straight spine; flowers pedicelled; calyx deeply parted, hairy on the outside; stamens 9 or 6.

Arid valleys, Colorado and Mohave deserts north to Inyo Co.; southerly Sierra Nevada and San Carlos Range. S. Nevada, Arizona.

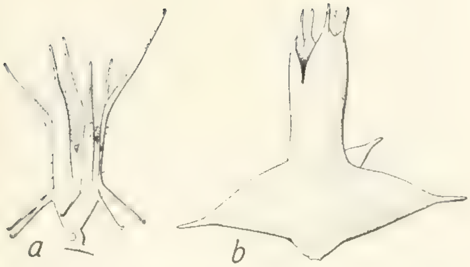

Fig. 70. *a*, CHORIZANTHE LEPTOCERAS Wats.; involucre. *b*, C. THURBERI Wats.; involucre, x 6.

A singular species remarkable for its saccate spurs. The spurs do not diverge symmetrically but 2 of them stand almost opposite with the third spur equidistant between them on one side. The side of the involucre opposite the third spur is therefore somewhat flattish (Helen Gilkey) and the single-toothed lobe of the tube (with its single nerve) stands over the interval between the nearly opposite spurs, whereas double-toothed lobes and double nerves correspond to the other intervals. This species is the type of Gray's Centrostegia, which by reason of its saccate spurs, peculiar involucral teeth and parted calyx, has some claims to consideration as a monotypic genus.

Locs.—Jacumba, *D. Cleveland;* San Felipe, *T. Brandegee;* Cuyamaca, *K. Brandegee;* Coyote Cañon, *Jepson* 1432a; Lancaster, *Hall & Chandler* 7387; Victor, *Jepson* 5617; Kramer, *Jepson* 5341; Mt. Pinos, *Hall* 6349; Tehachapi Pass, *Stokes;* Kernville, *T. Brandegee;* inner South Coast Range at Alcalde (acc. Zoe, 4: 158); Panamint Mts., *Hall & Chandler* 6978; Bishop, *Hall & Chandler* 7276.

Refs.—CHORIZANTHE THURBERI Wats. Proc. Am. Acad. 12: 269 (1877). Var. *cryptantha* Curran, Bull. Cal. Acad. 1: 275 (1885), type loc. Lancaster. *Centrostegia thurberi* Gray; Benth. in DC. Prodr. 14: 27 (1856), type loc. San Felipe, *Thurber;* Torr. Pac. R. Rep. 7^3: 20, pl. 8 (1856).

10. **OXYTHECA** Nutt.

Slender annuals with the internodes more or less covered with stipitate glands and a repeatedly dichotomous inflorescence. Leaves in a rosette at base. Bracts more or less connate, often in 3s. Involucres 2 to several-flowered, more or less pedicellate, mostly turbinate, 4 or 5-cleft, each lobe bearing a bristle or awn. Flowers mostly exserted. Calyx glandular or pubescent on the outside. Stamens 9. Achene commonly lenticular.—About 8 Pacific Coast species in North America and 1 in Chile. (Greek oxus, sharp, and theke, case, in allusion to the spiny involucre.)

Involucres lobed.
  Involucres 5-lobed; bracts united only at base.
    Involucres deeply parted into linear to obovate lobes.
      Plants prostrate; involucres sessile..............................1. *O. luteola.*
      Plants erect; involucres pedicelled.
        Calyx-lobes entire ....2. *O. caryophylloides.*
        Calyx-lobes cleft ....3. *O. trilobata.*
    Involucre a shallowly-lobed concave disk; calyx-lobes fimbriate.....4. *O. emarginata.*
  Involucres acutely 4-lobed; plants erect.
    Bracts completely united into a round concave perfoliate disk; involucres sessile or nearly so ....5. *O. perfoliata.*
    Bracts united only at base; involucres mostly pedicelled.
      Leaves revolute ....6. *O. dendroidea.*
      Leaves plane ....7. *O. watsonii.*
Involucral tube short, not lobed, its margin with 14 to 21 bristles............8. *O. parishii.*

1. **O. luteola** Parry. Stems prostrate, several from the base, branching, 2 to 5 inches long; herbage usually yellowish; leaves basal and in pairs at the lower nodes, rounded, 1 to 2 lines long, the petioles mostly longer; bracts linear, acerose, in 2s or 3s; involucres in the forks and along the branchlets, parted almost to the base into 5 unequal divisions, the divisions linear, acerose or

bristle-tipped, 1 to 3 lines long; flowers 7 to 11; calyx-tube subglobose, woolly, the glabrous yellow lobes spreading from its orifice.

Local species, known only from Lancaster in the Mohave Desert.

Ref.—OXYTHECA LUTEOLA Parry, Bull. Torr. Club, 10: 23 (1883), type loc. Lancaster, *Parry* 259.

2. **O. caryophylloides** Parry. Stem erect but diffusely branching above the base, 7 to 10 inches high, the involucres numerous along the branchlets and terminal, on pedicels 1 to 4 lines long; herbage glabrous or nearly so; leaves basal, obovate to oblong-spatulate, contracted to a petiole, ¾ to 2 inches long; bracts foliaceous, 3-parted into oblong divisions; involucres deeply parted into 5 nearly equal divisions, the divisions oblong, or a little widened upward, and abruptly awned; flowers 2 or 3; calyx short, greenish, obscurely lobed.

San Bernardino and San Jacinto mountains, 4000 to 6000 feet.

Locs.—Deep Creek, San Bernardino Mts., *Hall;* Fuller's Mill, Mt. San Jacinto, *Hall.*

Ref.—OXYTHECA CARYOPHYLLOIDES Parry, Proc. Davenp. Acad. 3: 175 (1882), type loc. San Bernardino Mts., *Parish Bros.* 1097.

3. **O. trilobata** Gray. Stems one, sometimes several from the base, once trichotomous, then dichotomous, 4 to 14 inches high, the branches spreading; leaves in a basal tuft, spatulate, ⅓ to 2 inches long, a little hairy; herbage sparingly glandular; bracts 3-lobed, the lobes acerose; involucres glabrous, glaucous, deeply 5-parted, borne on slender pedicels; pedicels solitary in the forks and axils of the bracts; involucre deeply lobed, its lobes oblong or spatulate, tipped with a bristle, 2 to 3 lines long; calyx segments 3-cleft into lanceolate acuminate lobes slightly erosulate on the sides.

Dry valleys: San Bernardino Valley south to San Diego Co.

Locs.—San Bernardino, *Parish* 3795; Mt. San Jacinto, *Hall* 2082, *Jepson* 2283; Coyote Cañon, *Jepson* 1434; between Julian and Cuyamaca, *K. Brandegee* (involucral lobes broad, often 2 or 3-toothed), *Abrams* 3807; Descanso, *Stokes;* Jacumba, *Abrams* 3663.

Ref.—OXYTHECA TRILOBATA Gray, Proc. Am. Acad. 12: 83 (1876), type loc. San Bernardino Valley, *Lemmon & Parry.*

4. **O. emarginata** Hall. Stem erect, tri- and di-chotomous, 2 to 6 inches high, the involucres in the forks and terminal on pedicels 1 to 6 lines long; herbage reddish, sparingly and minutely glandular; leaves in a basal rosette, oblanceolate, 4 to 8 lines long; bracts mostly 3-lobed; involucres obpyramidal, 2 to 3 lines high, shallowly 5-lobed, the lobes rounded, scarious-margined, awn-tipped; flowers 4; calyx 6-parted, its segments oblanceolate, fimbriate at apex.

Ridges about Tahquitz Peak, San Jacinto Mts., July. A rare and interesting species; possibly passed over elsewhere for O. perfoliata which it superficially resembles.

Ref.—OXYTHECA EMARGINATA Hall, Univ. Cal. Publ. Bot. 1: 75, pl. 14 (1902), type loc. Tahquitz Peak, *Hall* 2331.

5. **O. perfoliata** T. & G. Stem erect but short, parting at the first node into 2 or 3 horizontally spreading branches 2 to 4 inches long; herbage slate-color or reddish, glabrous except a glandular band on lower half of internodes; leaves of the basal rosette oblong-oblanceolate, green, 6 to 12 lines long; bracts at first node 3 or 4, small, united only at base, the upper bracts very conspicuous, orbicular- or deltoid-perfoliate, spine-tipped at the angles, 4 to 9 lines broad, glaucous; involucre narrowly turbinate, 3 to 4 lines long, deeply and acutely 4-lobed, each lobe bristle-tipped; calyx whitish, ⅔ line long, the outer segments minutely white-scaly.

Mohave Desert northward to Lassen Co. Nevada, Arizona.

Locs.—Victor, *Hall* 6181; Barstow, *Jepson* 5517; Argus Mts., *Purpus* 5315; Springville, Middle Tule River, *Purpus* 6054; Honey Lake Valley, *Davy.*

Refs.—OXYTHECA PERFOLIATA T. & G. Proc. Am. Acad. 8: 191 (1870), type specimens from Nev.; Wats. Bot. King, 311, pl. 34, figs. 1-3 (1871).

6. **O. dendroidea** Nutt. Stem erect, tri- and di-chotomously branching above the base, 7 to 14 inches high, hispidulose-glandular, the involucres nearly sessile or shortly pedicelled along the branchlets, or those in the forks mostly on pedicels 1 to 4 lines long; leaves linear to oblanceolate, revolute, acute, thinly hirsute, ¾ to 1½ inches long; involucres narrowly turbinate, ½ to 2 lines long, 4-lobed, the lobes with very unequal awns or sometimes the awns obsolete; flowers about 3; calyx pale rose or whitish, rough pubescent, very shortly lobed.

Lassen Co., not otherwise known in California. North to Washington and easterly through northwestern Nevada to Wyoming.

Locs.—Honey Lake, *Brandegee;* Reno, Nev., *Jepson* in 1896.

Ref.—Oxytheca dendroidea Nutt. Jour. Acad. Phila. ser. 2, 1: 169 (1848), type loc. Snake River sandhills, Rocky Mts., *Nuttall.*

7. **O. watsonii** T. & G. Stem erect, dichotomously branching above the base, 6 to 9 inches high, glaucous; leaves spatulate, ½ to 1 inch long; bracts awned, reflexed; involucres turbinate, 4-lobed, with elongated awns, 1½ lines long, borne on pedicels 2 to 5 lines long; flowers ½ line long, white, puberulent.

Cushenberry Sprs., Mohave Desert, *S. B. & W. F. Parish* 1241. Nevada. The awned bracts are reflexed in Nevadan plants, but apparently not so in the Parish specimens.

Refs.—Oxytheca watsonii T. & G. Proc. Am. Acad. 8: 191 (1870), type loc. Monitor Valley, Nev., *Watson;* Wats. Bot. King, 311, pl. 33, figs. 5-7 (1871).

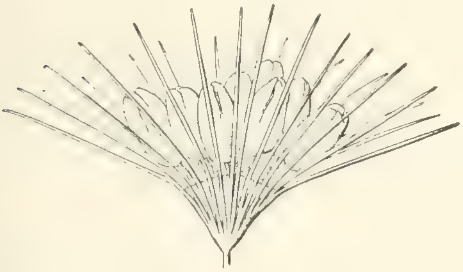

Fig. 71. Oxytheca parishii Parry; involucre, x 5.

8. **O. parishii** Parry. (Fig. 71.) Stem erect, diffusely but sparingly tri- and di-chotomous above the base, 8 to 14 inches high, glabrous and glaucous except a hispidulose-glandular band on the lower part of the internodes and on the pedicels; leaves basal, spatulate-obovate, ½ to 1¼ inches long; bracts small, 3-cleft; involucres on axillary and terminal pedicels (¼ to 1¼ inches long), the tube turbinate, short (1 line long), but developing from its margin a circle of 14 to 21 excurrent bristles 2 to 3 lines long; flowers 5 to 14, pedicelled; calyx 6-cleft nearly to base, its lobes linear-oblong, almost distinct, pubescent on back; stamens 9.

San Gabriel and San Bernardino mountains, and north to Mt. Pinos, 4500 to 6500 feet.

Locs.—Mt. Wilson, *Davidson, Stokes;* Swartout Cañon, Mt. San Antonio, *Hall* 1250.

Refs.—Oxytheca parishii Parry, Proc. Davenp. Acad. 3: 176 (1882), type loc. San Bernardino Mts., *Parish Bros.* 993. This species has been made the type of the monotypic genus Acanthoscyphus, Small, Bull. Torr. Club, 25: 53 (1898), a genus resting essentially on the numerous involucral awns. While this is a striking character, it may be pointed out that the awns are sometimes few and that Oxytheca trilobata sometimes displays multiple teeth or awns. *O. abramsii* McGregor, Bull. Torr. Club, 36: 605 (1909), type loc. Topatopa Mts., Ventura Co., *Abrams & McGregor* 72, is a form with fewer (7 to 12) awns. Hall's 6452, Mt. Pinos, is the same.

11. **ERIOGONUM** Michx.

Annual or perennial herbs or small shrubs with basal or alternate or whorled leaves without stipules, those of the inflorescence commonly reduced to bracts. Flowers perfect, borne in an involucre, more or less exserted on their stalklets and commonly reflexed or recurved in age, intermixed with narrow scarious bractlets. Involucres 4 to 8-toothed or -lobed, several to many-flowered, borne in heads, peduncled umbels, or solitary along the branches (either sessile or on "pedicels"), or terminal on scape-like stems. Calyx 6-parted or -cleft, colored, persistent about the achene. Stamens 9, inserted on the base of the calyx. Styles 3; stigmas minute, capitate. Achene triangular, except in a few species. Embryo straight, in the axis of scanty endosperm; cotyledons foliaceous.—About 140 North American species, mostly western. (Greek erion, wool, and gonu, knee or joint, the nodes hairy in some species.)

The species of Eriogonum often show considerable variability. Favorable or unfavorable conditions react most strikingly on the stems, branches and involucres, and least on the leaves which are very constant in texture, outline and size. The leaves in the herbaceous species are usually in a basal rosette, but even when typically so leaves may occasionally develop freely at the nodes, as in E. virgatum, gracile, vimineum and dasyanthemum. Vigorous individuals often develop many stems from the base (E. vimineum, caninum, and truncatum), or when less vigorous branch only at first node or sparingly. The size and degree of branching of the inflorescence is characteristically variable, particularly in the E. umbellatum and E. nudum groups. Simple and compound umbels are often borne on the same individual, and umbels are often condensed to a capitate condition or indeed reduced to a single involucre. Inflated stems may be expected in any form of the E. inflatum and E. nudum allies. Where there are several stems from the base, inflated and non-inflated stems may sometimes be borne in the same rosette, as in E. inflatum and in E. trichopodum. The shape of the flower is important, but inasmuch as in many species the flower changes in shape between anthesis and fruiting, invariable features in this regard should be guardedly separated from such characters as are subject to modification as growth proceeds. For example, in E. incanum the short stipe-like base of the flower in its early condition is abruptly expanded into a bowl-shaped upper portion; later the calyx becomes vase-shaped and twice or thrice as long. In E. thomasii the calyx segments are nearly plane in early anthesis, in fruit they are twice as large and conspicuously saccate. In certain species some of the flowers in an involucre, especially the more shortly pedicelled ones, are sometimes found to be staminate, a condition also met with occasionally in species of Chorizanthe and Oxytheca. According to Miss S. C. Stokes, hybrids are quite common in some of the groups. In Eriogonum fasciculatum the glandular area at base of the calyx which provides the honey flow harvested by the domestic bee is very distinct. A similar area exists in E. nudum but is far less developed. Both species are protandrous. Honey areas appear to be absent from the calices of E. vimineum and its allies.

A. Calyx not stipe-like at base.

Involucres turbinate or campanulate, 4 or 5-toothed or lobed, not angled, always borne on scattered pedicels, never congested in heads; annuals (except nos. 9 and 10); mostly deserts or arid plains.—Subgenus GANYSMA.

Plants with leaves at the nodes in the axils of the bracts as well as in a basal rosette, involucres 4-lobed or -toothed.

Involucres not cottony.

Inner and outer calyx-lobes very unlike........................1. *E. angulosum.*

Inner and outer calyx-lobes nearly alike....................2. *E. gracillimum.*

Involucres conspicuously cottony...............................3. *E. gossypinum.*

Plants with the leaves all in a basal rosette (except nos. 4 and 8), rarely in the axils of the lower bracts; inflorescence with small bracts at the nodes, the bracts in 3s, triangular or oblong, and often more or less connate at base.

Involucre 4-lobed or -toothed, few (usually 1 to 3)-flowered.

Calyx nearly glabrous ....4. *E. spergulinum.*

Calyx at least in fruit with hooked bristles.

Involucres 2-flowered; achene exserted...................5. *E. hirtiflorum.*

Involucres 4 to 6-flowered; achene not exserted..............6. *E. inerme.*

Calyx hairy or glandular-hispid, its hairs not hooked.

Calyx segments notched or 3-toothed at apex...........7. *E. apiculatum.*

Calyx segments entire.

Leaves tomentulose or glabrate..........................8. *E. ordii.*

Leaves hairy pubescent.

Calyx pinkish ....9. *E. parishii.*

Calyx yellow ....10. *E. trichopodum.*

Involucre 5-lobed or -toothed, several-flowered.

Calyx hairy or pubescent.

Stems usually inflated; leaves hairy-pubescent............11. *E. inflatum.*

Stems not inflated or rarely.

Calyx segments not saccate-dilated.
Leaves obovate or rounded; involucres glandular...12. *E. pusillum.*
Leaves reniform; involucres not glandular.......13. *E. reniforme.*
Outer calyx segments saccate-dilated on each side......14. *E. thomasii.*
Calyx glabrous.
Pedicels erect ....15. *E. thurberi.*
Pedicels not erect.
Outer calyx segments obovate; involucres on nodding pedicels.
Calyx attenuate at base........................16. *E. cernuum.*
Calyx not attenuate at base......................17. *E. nutans.*
Outer calyx segments cordate at base.
Involucres on divaricately spreading pedicels 1 to 4 lines long...... 18. *E. watsonii.*
Involucres on deflexed pedicels 1 line long or less...19. *E. deflexum.*

Involucres cylindric or cylindric-turbinate, 5-toothed, 5 (or 6)-nerved or angled, always sessile, solitary or congested in heads; annuals, perennial herbs, or shrubs; mostly deserts or dry foothills.—Subgenus OREGONIUM.

Involucres solitary, usually scattered.
Annuals; leaves mostly in a rosette at base.
Flowering branches mostly elongated.
Calyx glabrous; involucres (except the terminal) hugging the branches.
Plant compactly branching; outer calyx segments fan-shaped with strongly incurved sides ....20. *E. nidularium.*
Plant diffusely or strictly branched.
Involucres narrowly turbinate, glabrous or nearly so, the teeth prominent.
Petioles not winged; stems and leaves white-woolly......... 21. *E. gracile.*
Petioles conspicuously winged; stems and leaves less tomentose 22. *E. citharaeforme.*
Involucres cylindric, almost truncate, the teeth minute.
Stems, leaves and involucres white-woolly.....23. *E. virgatum.*
Stems glabrous, rarely a little woolly below.
Involucres 1¾ to 2½ lines long........24. *E. molestum.*
Involucres ½ to 1½ lines long.
Involucres 1 to 1½ lines long, usually fluted and often obscurely constricted a little at tip........ 25. *E. vimineum.*
Involucres ½ to ⅞ line long, not fluted........... 26. *E. baileyi.*
Calyx densely hairy; involucres spreading a little from the branches........ 27. *E. dasyanthemum.*
Flowering branches not elongated.
Repeatedly and shortly forked; flowers yellow...........28. *E. mohavense.*
Bearing an irregularly compound umbel.................29. *E. truncatum.*
Perennials with densely leafy short woody stems.
Inflorescence racemose.
Leaves roundish, densely imbricated on the caudex..........30. *E. saxatile.*
Leaves not roundish.
Involucres scattered on the few elongated branches.
Involucres scattered, 2 to 3 lines long...........31. *E. elongatum.*
Involucres scattered or sometimes approximate towards the ends of the branches, 1 to 1½ lines long.........32. *E. wrightii.*
Involucres secund and crowded on the short branchlets..33. *E. nodosum.*
Inflorescence cymose or paniculate.
Peduncles bearing a divaricately branched panicle.
Involucral teeth glabrous ....34. *E. heermannii.*
Involucral teeth pubescent ....35. *E. plumatella.*
Peduncles bearing corymbose cymes..................36. *E. microthecum.*
Involucres 2 to several in heads, rarely solitary; perennials.
Calyx-lobes similar or nearly so, nearly equal.
Not caespitose.
Shrubs, at least woody at base; stems very leafy, commonly fascicled.
Heads or involucres in a dense compound cyme; insular species.

Leaves elliptic or oblong.....................37. *E. arborescens.*
Leaves linear ....38. *E. giganteum.*

Heads not in a compound cyme; mainland species or mostly.
Heads terminal on the 2-forked peduncles or racemosely disposed on the forks; leaves mostly ovate or roundish.
Calyx silky; filaments glabrous; leaves ashy beneath........ 39. *E. cinereum.*
Calyx glabrous; filaments hairy at base; leaves white-lanate beneath ....40. *E. parvifolium.*
Heads umbellate, sometimes solitary and terminal; filaments glabrous or nearly so; leaves oblong or linear............. 41. *E. fasciculatum.*
Herbaceous or mostly so, leafy only at base; heads umbellate or usually so.
Stems not fistulous; heads 1 or few; seashore.......42. *E. latifolium.*
Stems fistulous; heads several to many.
Leaves spreading, oblong or ovate, obtuse, ½ to 2 inches long...... 43. *E. nudum.*
Leaves erect, ovate to ovate-lanceolate, acute, 1 to 3 (or 5) inches long ....44. *E. elatum.*
Stems with trumpet-inflated lower internodes; involucres solitary, racemose 45. *E. inflatum.*

Caespitose.
Involucres very angular, 5-toothed......................46. *E. kennedyi.*
Involucres not angular, in age bladdery, 6 to 8-toothed................. 47. *E. ochrocephalum.*
Calyx-lobes dissimilar, the outer somewhat cordate at base, attached only by the lower third of the midvein; stems scape-like.
Stems bearing a single head...........................48. *E. ovalifolium.*
Stems bearing a simple or irregularly compound umbel........49. *E. proliferum.*

B. Calyx stipe-like at base.

Involucres turbinate, 4 to 8-toothed or lobed, either solitary or borne in umbels, the umbels sometimes congested in heads; flowering stems scape-like; perennial herbs; mountains from middle altitudes to alpine.—Subgenus Eueriogonum.

Involucres with reflexed lobes, the lobes often long.
Calyx hairy.
Peduncles scape-like, bearing a solitary involucre, rarely an umbel.
Calyx yellow.
Peduncles naked ....50. *E. caespitosum.*
Peduncles bearing a whorl of bracts at the middle....51. *E. douglasii.*
Calyx whitish ....52. *E. sphaerocephalum.*
Peduncle bearing a 3-rayed umbel.........................53. *E. tripodum.*
Calyx glabrous.
Peduncles bearing a solitary involucre...................54. *E. siskiyouensis.*
Peduncles bearing a simple or compound umbel.
Peduncles scape-like, erect or nearly so.
Leaves mostly spreading, ½ to 1 inch long; umbel simple or compound.
Leaves more or less tomentose................55. *E. umbellatum.*
Leaves glabrous ....56. *E. torreyanum.*
Leaves erect, 1 to 3 inches long; umbel compound...57. *E. compositum.*
Peduncles decumbent ....58. *E. lobbii.*
Involucres with short erect teeth.
Involucres in heads or umbels.
Calyx villous or hairy.
Leaves glabrous ....59. *E. pyrolaefolium.*
Leaves hairy ....60. *E. latens.*
Calyx glabrous.
Bracts mostly linear, abundant ....61. *E. ursinum.*
Bracts small, inconspicuous.
Rays ½ inch long or less, or umbels capitate; crown compact........ 62. *E. incanum.*
Rays ½ to 1½ inches long; crown loose...........63. *E. marifolium.*
Involucres solitary.
Calyx whitish or pinkish...............................64. *E. kelloggii.*
Calyx yellow ....65. *E. alpinum.*

I.—Subgenus Ganysma.

Involucres campanulate or broadly turbinate, not angled, never congested in heads, always borne on filiform and usually elongated pedicels and disposed in racemes or panicles, often drooping or recurved; bracts in 3s, small, rigid, mostly oblong to triangular; calyx often accrescent, not stipe-like at base; ovary and filaments glabrous; annuals (except nos. 9 and 10); mostly of the deserts or arid plains.

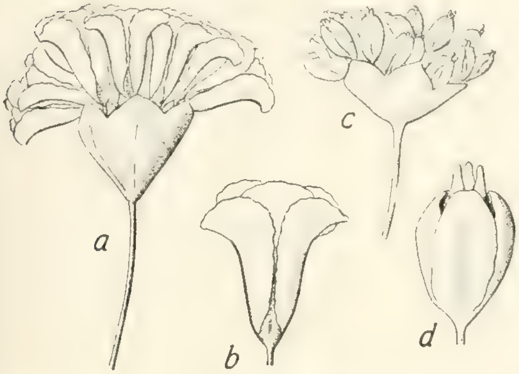

Fig. 72. *a*, ERIOGONUM GRACILLIMUM Wats., involucre; *b*, flower; *c*, E. ANGULOSUM Benth., involucre; *d*, flower. Involucres, x 4; flowers, x 10.

1. **E. angulosum** Benth. (Fig. 72c, d.) Stems diffusely and repeatedly dichotomous from near the base, 3 to 14 (or 24) inches high, the branches 4 to 6-angled; stems and leaves whitish tomentose, or glabrate and green; basal leaves roundish to broadly oblong or lanceolate, commonly undulate, ½ to 1 inch long, on rather short petioles; upper leaves oblong to lanceolate or oblanceolate, sessile or nearly so; pedicels of the involucres 3 to 8 lines long, in the forks or terminal; involucres turbinate or hemispherical, 1 line long, minutely glandular, woolly inside; calyx segments white or pink, ½ to ¾ line long, minutely glandular-puberulent, the outer (with darker centre) obovate or ovate, concave, the inner linear or lanceolate, distinctly longer than the outer, all abruptly short-clawed.

South Coast Ranges to the upper San Joaquin Valley, Southern California, the Mohave Desert, and Inyo Co. Arizona to Washington. Lower California.

Var. **viridescens** Jepson n. comb. Leaves oval to elliptic; calyx greenish.—Kern Co. Possibly a seasonal abnormality.

Var. **maculatum** Jepson n. comb. Close to preceding; basal leaves oval, not revolute, ¾ to 1 inch long and ½ to ¾ inch wide; involucre more deeply lobed; outer calyx segments yellowish with an oblong red blotch.—Desert valleys, Victor, Kramer and Barstow to Inyo Co. and north to Reno, Nev.

Refs.—ERIOGONUM ANGULOSUM Benth. Trans. Linn. Soc. 17: 406, t. 18, fig. 1 (1837), type from California, *Douglas*. Var. *flabellatum* Gand. Bull. Soc. Roy. Bot. Belg. 42: 187 (1905), east base of Sierra Nevada on Central Pacific R. R. Not seen by us. Var. VIRIDESCENS Jepson. *E. viridescens* Heller, Muhl. 2: 25 (1905), type loc. Sunset, *Heller* 7733. Var. MACULATUM Jepson. *E. maculatum* Heller, Muhl. 2: 188 (1906), type loc. Laws, Inyo Co., *Heller* 8233.

2. **E. gracillimum** Wats. (Fig. 72a, b.) Stems many from the base, diffuse, repeatedly dichotomous and very slender above, 4 to 10 (or 24) inches high; herbage thinly woolly, especially on the under side of the leaves; basal leaves spreading, oblong to lanceolate, ¾ to 1½ inches long, narrowed below, sessile or shortly petioled, the cauline sessile, erect, oblong-lanceolate, acute, blistery-dilated, strongly revolute, ¾ to 1 inch long; involucres turbinate, borne on filiform pedicels 4 to 8 lines long; calyx pink, minutely glandular-hispid outside, 1 line long, the tips of the segments white and erosulate; outer segments broadly oblong, erect with the white tips abruptly spreading, the edges below the tips incurved; inner segments like the outer but smaller.

Sandy soil, Mohave Desert north to the upper San Joaquin Valley and westerly to San Luis Obispo Co.

Locs.—Mohave Desert, *Jepson* 5322 (Kramer), 5615 (Victor); San Emigdio, Kern Co., *Davy* 1968; Santa Maria River, *Blochman*; Estrella, *Jared*.

Refs.—ERIOGONUM GRACILLIMUM Wats. Bot. Cal. 2: 480 (1880), type loc. Mohave Desert, *Bush*. *E. variable* Heller, Muhl. 2: 24 (1905), type loc. Mohave, *Heller* 7756. *E. angulosum* var. *victorense* Jones, Contrib. 12: 74 (1908), type loc. Victor, Mohave Desert, *Jones*.

3. **E. gossypinum** Curran. Diffusely branched from the base, 4 to 10 inches high, thinly tomentose throughout or the upper parts glabrate; leaves oblanceolate, narrowed to a short petiole, or the upper oblong or lanceolate and mostly sessile, 1 to 2 inches long; involucres 1½ lines long, borne on pedicels 1 to 6 lines long, turbinate, cleft to the middle, glabrous outside, heaped inside with a cottony wool in which the 5 to 8 flowers are concealed; calyx ½ line long, obscurely puberulent, the outer segments oblong or spatulate, the inner linear, acuminate, longer.

Upper San Joaquin Valley. A remarkable species.

Locs.—Kern Co.: Oil City, *Heller* 7748; Caliente Creek, *Davy* 1885.

Refs.—ERIOGONUM GOSSYPINUM Curran, Bull. Cal. Acad. 1: 274 (1885), type loc. Bakersfield; Greene, Fl. Fr. 152 (1891).

4. **E. spergulinum** Gray. Stems erect, dichotomously branching, 4 to 11 inches high, minutely glandular pubescent or the upper half of the internodes usually glabrous; leaves linear, revolute, hairy, ½ to 1½ inches long, in whorls at the base of the stem and at the lower forks, reduced above to small bracts; involucres ¼ line long, deeply 4-toothed, on pedicels 3 to 6 lines long; bractlets none; calyx white with pink midveins, ¾ to 1¼ lines long, obscurely puberulent at base, the segments oblong-quadrate, erosulate at apex or merely acute.

Mountain slopes, North Coast Ranges and Sierra Nevada, 5000 to 9000 feet.

Locs.—Snow Mt., Lake Co., *K. Brandegee;* South Yollo Bolly, *Jepson;* Ash Creek, Siskiyou Co., *M. S. Baker;* Lassen Peak, *Jepson* 4071; Spanish Peak, *Mrs. R. M. Austin;* Summit, Nevada Co., *Jepson;* Yosemite, *Lembert;* Little Yosemite, *Jepson* 3152, 4402; Mt. Silliman, *Jepson* 716; near Mt. Whitney, *Jepson* 948; Alta Mdws., *Hopping* 509; near Kaweah Peaks, *Jepson* 5008; Sky Valley, Tulare Co., *Eastwood;* Mt. Pinos, *Hall* 6659.

Refs.—ERIOGONUM SPERGULINUM Gray, Proc. Am. Acad. 7: 389 (1868), type loc. Big Creek, near Mariposa Grove, *Bolander*. *Oxytheca spergulina* Greene, Fl. Fr. 153 (1891). *O. reddingiana* Jones, Bull. Torr. Club, 9: 32 (1882), type loc. Soda Sprs. near Donner.

5. **E. hirtiflorum** Gray. Repeatedly dichotomously branched, 4 to 9 inches high, the stems lightly sprinkled with minute often stipitate glands, otherwise glabrous; leaves obovate, drawn down to a petiole-like base, sparingly hirsutulose, especially on the margins, ½ to 1½ inches long; involucres sessile along the branches and in the forks, or often on pedicels 1 to 3 lines long, narrow, 2-flowered; calyx reddish, ½ line long, its segments oblong, clothed with hooked hairs on the back; achene exserted.

Middle altitudes, Sierra Nevada and North Coast Ranges.

Locs.—Old Colony Mill, *Jepson* 626; Giant Forest and Ockenden, *K. Brandegee;* Coulterville, *Jepson;* Mariposa, *Congdon;* Bartletts, Lake Co., *T. Brandegee;* Mt. Konocti, *Jepson;* Scotts Valley, Lake Co., *J. P. Tracy* 1650; Red Mt., Mendocino Co., *Eastwood;* Edgewood, *Brandegee*.

Refs.—ERIOGONUM HIRTIFLORUM Gray; Wats. Proc. Am. Acad. 12: 259 (1877), type loc. Tuolumne Co., Sierra Nevada, *Gray*. *Oxytheca hirtiflora* Greene, Fl. Fr. 153 (1891); Jepson, Erythea, 1: 14 (1893), Fl. W. Mid. Cal. 151 (1901). A species closely connecting Eriogonum and Oxytheca, a reference to the latter genus satisfying in some respects its natural affinities. Such a reference would, however, also involve the transfer of its near allies, *E. spergulinum, inerme, apiculatum, ordii* and *parishii*.

6. **E. inerme** Jepson n. comb. Stems 1 to 3 from the base, repeatedly and divaricately dichotomous, 3 to 10 inches high; leaves in a basal rosette, broadly spatulate, ½ to 1 inch long, sessile, glabrous save the ciliate margin; bracts (2 or 3 lines long) and branches hispidulose-glandular; involucres 4-cleft nearly to the base, 3 to 6-flowered, shortly pedicelled (pedicels ¼ to ½ line long); flowers rose-color; calyx hispid, its hairs hooked at tip, at least in age; inner calyx segments smaller than the outer and retuse.

San Bernardino Mts. north to Monterey and San Benito cos. in the Coast Ranges and to Tulare Co. in the southern Sierra Nevada.

Locs.—Sequoia Mills, *Brandegee;* Middle Tule River, *Purpus* 1685; Havilah, Kern Co., *K. Brandegee;* Tehachapi, *K. Curran;* Priest Valley, Hernandez, and Pacific Valley, *Eastwood.*

Refs.—ERIOGONUM INERME Jepson. *Oxytheca inermis* Wats. Proc. Am. Acad. 12: 273 (1877), type from California, *Miss M. J. Bancroft.* *Eriogonum vagans* Wats. Proc. Am. Acad. 20: 370 (1885).

7. **E. apiculatum** Wats. Stems erect, trichotomously branching, ½ to 2 feet high, the peduncles (2 to 4 lines long) in all the forks and terminal, the lower half of the internodes and peduncles somewhat glandular-pubescent; leaves in a basal cluster, obovate or oblanceolate, narrowed below to a petiole, 7 to 12 lines long, hirsute-glandular; involucre 1 to 3-flowered, glabrous, turbinate, nearly 1 line long, 4-lobed, the lobes oblong and as long as tube; pedicels spreading or even deflexed, 2 to 7 lines long; calyx red in the bud, white in flower, ¾ line long, puberulent outside, segments oblong-obovate, deeply notched with a slender point in the sinus, sometimes one or more merely truncate, obtuse or apiculate.

Mt. San Jacinto, 7800 to 8200 feet; Cuyamaca Mt. A dainty plant with peculiar calyx segments, closely allied to *E. parishii.*

Ref.—ERIOGONUM APICULATUM Wats. Proc. Am. Acad. 17: 378 (1882), type loc. Mt. San Jacinto, *Parish Bros.*

8. **E. ordii** Wats. Diffusely paniculate, 1½ to 2½ feet high, the lower parts thinly tomentose, or the leaves glabrate above; leaves in a rosulate basal cluster and in whorls at the lower nodes, roundish to obovate, 1½ to 2 inches long, or the upper smaller, petioled; involucres 4-toothed, ⅓ to ½ line long, 1 to 3-flowered, on pedicels 3 to 9 lines long; calyx dull white or pinkish, densely pubescent outside, ½ to ¾ line long, its segments ovate or oblong.

Caliente, Kern Co., *Davy* 1869; Split Mt., Colorado Desert, *Brandegee;* western Arizona.

Ref.—ERIOGONUM ORDII Wats. Proc. Am. Acad. 21: 468 (1886), type loc. Fort Mohave, Ariz., *Lemmon.*

9. **E. parishii** Wats. Stems 1 to 3, forming a diffusely branched panicle above the first node, 4 to 9 inches high, glaucous but somewhat viscid with stipitate glands; leaves in a basal cluster, broadly oblanceolate, hirsute, narrowed to a short petiole, ½ to 1½ inches long; pedicels 1 to 4 lines long; involucres 4-lobed at least to middle, ⅓ line long, 1 or 2-flowered; calyx pinkish, minutely pubescent, ½ line long, outer segments ovate, the inner oblong-spatulate.

Mountains of Southern and Lower California.

Locs.—San Bernardino Mts., *Abrams* 2983; Descanso, *Brandegee.*

Ref.—ERIOGONUM PARISHII Wats. Proc. Am. Acad. 17: 379 (1882), type loc. Bear Valley, San Bernardino Mts., *Parish Bros.*

10. **E. trichopodum** Torr. Annual or perennial; stems 1 or several from the base, erect, umbellately 3 to 11-forked at and above the first node, glabrous and glaucous, ½ to 1½ feet high; first internode often inflated upwards; leaves in a basal cluster, roundish, crinkly, hirsute-pubescent, 6 to 9 lines long on petioles 1 to 1½ times as long; involucres minute (¼ line long), 4-lobed, 2 to 4-flowered, on divaricately spreading hair-like pedicels 3 to 5 lines long; calyx yellow or greenish, densely white-hispidulose on back of the ovate segments, ½ to ¾ line long; inner and outer segments alike and equal.

Colorado and Mohave deserts north to Inyo Co. and the San Carlos Range. East to Utah and Arizona.

Locs.—Twentynine Palms, *T. Brandegee;* Ludlow, *Jepson* 5506; Lanfair, *Maye Tennent;* Calico Mts., *Jepson* 5412; Antelope Valley, *Davy* 2222; Providence Mts., *T. Brandegee;* Little Lake, Inyo Co., *Hall & Chandler* 7354; Alcalde (Zoe, 4: 158).

Refs.—Eriogonum trichopodum ("trichopes") Torr. Emory's Reconn. 151 (1848), type loc. mts. on the west side of the Colorado Desert. E. trichopodum Torr.; Benth. in DC. Prodr. 14:20 (1856).

11. **E. inflatum** Torr. & Frem. Desert Trumpet. (Fig. 73.) Annual or perennial; stems several from the base, repeatedly tri- and di-chotomous, forming a diffuse panicle, ½ to 3 feet high, glabrous, glaucous; lower internodes, especially the lowest peduncle-like one, strongly or slightly inflated upwards or rarely not at all; leaves roundish or round-ovate, cordate at base, 4 to 12 lines long, sometimes to 1½ inches long, short hirsute but green, on

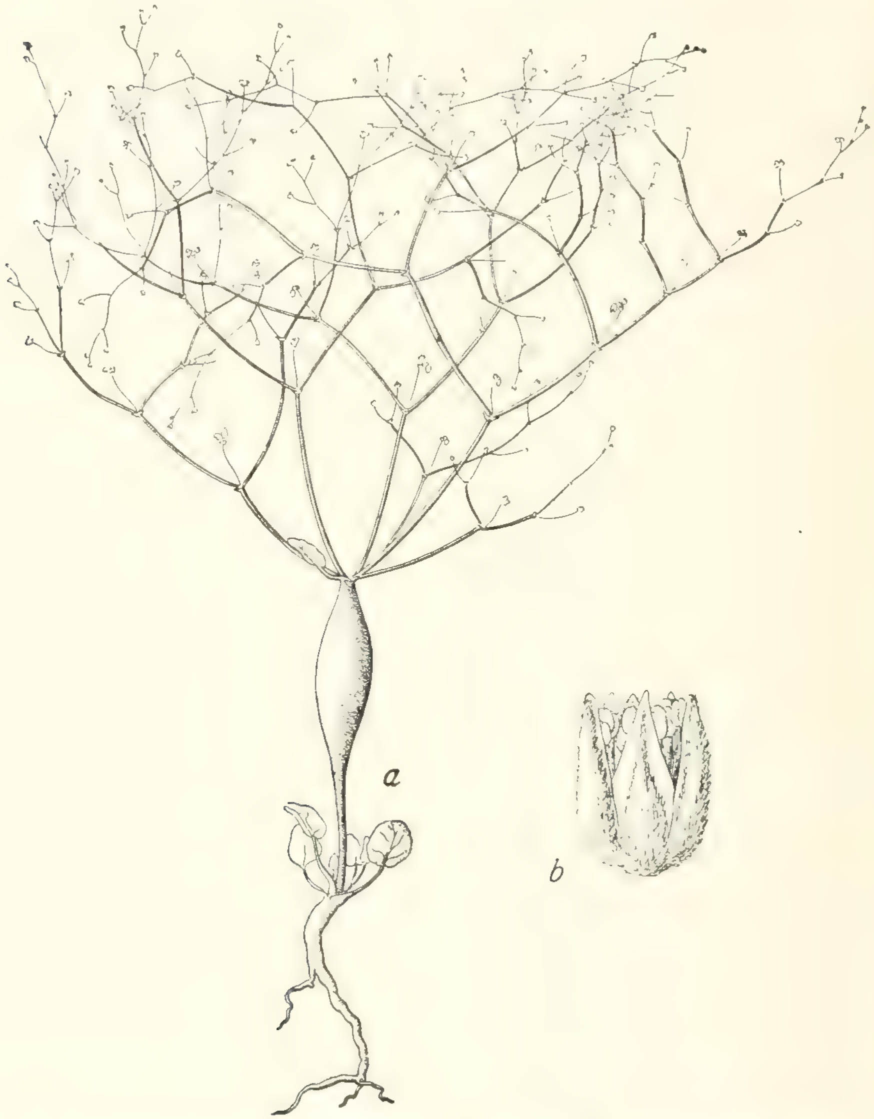

Fig. 73. Eriogonum inflatum Torr. & Frem. *a*, habit, x ¼; *b*, calyx, showing the broad scarious margins of the inner segments, and the very narrow margins of the outer segments, x 12.

petioles 1½ to 2 times as long; pedicels racemose and in the forks, divaricately spreading, 4 to 10 lines long; involucres 3 to 7-flowered, glabrous, turbinate, 5-toothed, ½ line long, in age crowded with linear or oblong bractlets; calyx yellowish, 1 line long, all the segments densely whitish hispid along middle of back, the outer segments lanceolate, their edges revolute and thus becoming linear-lanceolate, the inner segments triangular-lanceolate, with scarious margins.

Colorado and Mohave deserts, north to the San Carlos Range; east to Utah and New Mexico.

Locs.—Coachella, *Greata;* east base Mt. San Jacinto, *Hall* 1834; Providence Mts., *T. Brandegee;* Ludlow, *Jepson* 5509; Randsburg, *Heller* 7693; Barstow, *Jepson* 4778; San Carlos Range, *Lillis;* Keeler, *Hall & Chandler* 7172; Southern Belle Mine, *Heller* 8333.

Refs.—ERIOGONUM INFLATUM Torr. & Frem., Frem. Rep. Sec. Exped. 317 (1845), type loc. Mohave Desert, *Fremont;* Cov. Contrib. U. S. Nat. Herb. 4: 186 (1893). *E. clavatum* Small, Bull. Torr. Club, 25: 50 (1898), type from n. Lower Cal., *Orcutt*. *E. glaucum* Small, l. c. 51, type loc. Colorado Desert, *Orcutt*.

12. **E. pusillum** T. & G. Stems 1 or several from the base, 4 to 12 inches high, trichotomously branched at or from below the middle, glabrous; leaves ovate or rounded, 3 to 8 lines long, tapering at base into the petiole, floccculent-tomentose below, less so above, the green bracts and involucres glandular-pubescent; pedicels of the involucres glabrous, filiform, 4 to 14 lines long, in all the forks of the trichotomous panicle and terminal; involucre broadly turbinate; calyx yellow, the segments with red centres, minutely pubescent, 1 line long, the outer segments obovate, the inner oblong; filaments included.

Mohave Desert and north to Inyo Co. Nevada.

Locs.—Little Rock Creek, Los Angeles Co., *Davidson;* Lancaster, *Davidson;* Victor, *Jepson* 5619; Calico Mts., *Jepson* 5394; Randsburg, *Heller* 7685; Bishop Creek, *Hall & Chandler* 7272; Kernville, *Brandegee*.

Ref.—ERIOGONUM PUSILLUM T. & G. Proc. Am. Acad. 8: 184 (1870), type loc. foothills of the Trinity Mts., Nev., *Watson*.

13. **E. reniforme** Torr. & Frem. Stems 1 to several from the base, 2 to 6-forked, forming a diffuse plant 4 to 7 inches high; herbage glabrous and glaucous except the leaves and the slightly hairy lower internodes; leaves all basal, round-reniform or roundish, 5 to 11 lines broad, loosely white-woolly; petioles ½ to 2½ inches long; bracts glabrous but the margins loosely hairy; involucres glabrous, turbinate-campanulate, on pedicels 2 to 6 lines long; calyx whitish or yellowish, minutely glandular-puberulent, ¾ line long, the outer segments ovatish or elliptic, the inner broadly linear; filaments exserted.

Inyo Co. south to the Mohave and Colorado deserts. Lower California.

Locs.—Owens Lake, *Jepson* 5118; Keeler and Panamint Valley, acc. *Coville;* Ludlow, *Jepson* 5493; Barstow, *K. Brandegee;* Kramer, *Jepson* 5331; Victor, *Jepson* 5618; Twentynine Palms, *T. Brandegee* (involucres scarcely lobed).

Refs.—ERIOGONUM RENIFORME Torr. & Frem.; Frem. Rep. Sec. Exped. 317 (1845), type from California, *Fremont*, probably on the Mohave Desert; Cov. Contrib. U. S. Nat. Herb. 4: 188 (1893). *E. praebens* Gand. Bull. Soc. Roy. Bot. Belg. 42: 196 (1905), Sierra Valley, *Hillman*.

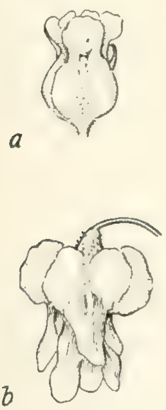

Fig. 74. ERIOGONUM THOMASII Torr. *a*, flower in anthesis, x 12; *b*, flower, fruiting stage.

14. **E. thomasii** Torr. (Fig. 74.) Stems 1 or several from the base, repeatedly and diffusely 2 to 8-forked, 4 to 8 inches high; leaves in a basal tuft, roundish, sometimes subcordate at base, 2 to 8 lines long, rather long-petioled, white-woolly or glabrate; pedicels in the forks and terminal, 2 to 9 lines long; involucres deeply 5-lobed, ½ line long, glabrous; calyx dull yellow, ⅓ to ½ line long, in age whitish and twice as long, hispidulose outside at base, the outer seg-

ments ovate, the margin in age saccate-dilated on each side of the cordate base, the inner segments linear-spatulate, finally exceeding the outer.

Colorado Desert, north to Inyo Co. East to Arizona and Utah.

Locs.—Calexico, *Abrams* 3152; Chuckawalla Spr., *Hall* 5899; Coachella, *Hall* 5812.

Refs.—Eriogonum thomasii Torr. in Pac. R. Rep. 5^2: 364 (1857), type loc. Ft. Yuma, *Major Thomas*. *E. minutiflorum* Wats. Proc. Am. Acad. 26: 125 (1891), type loc. Colorado Desert, *Orcutt*, Apr. 1890, the segments less strongly saccate, otherwise the same.

E. deserticolum Wats. Proc. Am. Acad. 26: 125 (1891), type loc. s.w. Colorado Desert, *Orcutt* 2189. Calyx yellow, villous. Very obscure; collected only once.

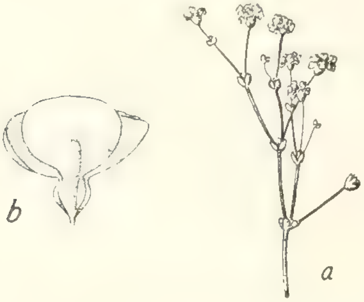

Fig. 75. Eriogonum thurberi Torr. *a*, flowering branchlet, x 1; *b*, flower, x 10.

15. **E. thurberi** Torr. (Fig. 75.) Stems 1 or several from the base, diffusely and trichotomously branched, 4 to 13 inches high, tomentulose towards the base; leaves in a basal rosulate cluster, ovate to broadly oblong, woolly below, less so above, ½ to 2 inches long, the petioles about as long or longer; peduncles in the forks and terminal, 2 to 12 lines long; involucres 1 line long, nearly hemispherical; calyx rose-red or white, ½ to ¾ line long; outer calyx segments roundish or transversely elliptic, abruptly narrowed to a broad claw, a floc of wool at summit of claw; inner calyx segments narrowly linear or lanceolate, somewhat hastately lobed near base, ¼ as wide as outer segments.

San Bernardino Valley south to San Diego Co. and Lower California, east to Arizona.

Locs.—San Bernardino Valley, *Parish, Jepson* 5563; Palm Cañon, Mt. San Jacinto, *Jepson* 1401; Temecula River, *Jepson* 1553.

Refs.—Eriogonum thurberi Torr. Bot. Mex. Bound. 176 (1859), type loc. San Pasqual, San Diego Co., *Thurber*. Var. *parishii* Gand. Bull. Soc. Roy. Bot. Belg. 42: 198 (1905), type loc. San Bernardino, *Parish* 2820.

16. **E. cernuum** Nutt. Stems glabrous, glaucous, diffusely di- or tri-chotomously branched, 6 to 14 inches high; leaves round to oval, white woolly below, glabrate above, 6 to 9 lines long, the petioles nearly as long; pedicels deflexed, ½ to 4 (or 7) lines long, somewhat racemose on the branches; involucres narrowly turbinate; calyx white, glabrous, ¾ to 1 line long, narrowed to a shortly clavate base, its segments obovate or somewhat quadrate, undulate, retuse, the inner half as broad.

Colorado Desert (Warren's Well, *Brandegee*). North to Nevada and Oregon, east to the Rocky Mts.

Ref.—Eriogonum cernuum Nutt. Jour. Acad. Phila. ser. 2, 1: 162 (1848), types from Columbia River plains and in the Rocky Mts., *Nuttall*.

17. **E. nutans** T. & G. Similar to E. cernuum but pedicels glandular; base of calyx very obtuse (attenuate in E. cernuum).

Northwestern Nevada. Lassen Co. acc. Bot. Cal. 2: 23.

Ref.—Eriogonum nutans T. & G. Proc. Am. Acad. 8: 181 (1870), type spms. from Lassen Co. and n.w. Nev.

18. **E. watsonii** T. & G. Similar to E. cernuum; stem sometimes a little inflated; branches erect; leaves round-cordate; pedicels divaricately spreading, 1 to 4 lines long; calyx segments oblong, subcordate at base.

Lockwood Valley, Mt. Pinos, *Dudley & Lamb* 4683; thence easterly to Nevada. An ill-defined species so far as the Californian material is concerned, apparently passing into E. deflexum.

Locs.—Tehachapi, *Stokes;* Walker Pass, *Brandegee*.

Refs.—Eriogonum watsonii T. & G. Proc. Am. Acad. 8: 182 (1870), type loc. Humboldt Mts., Nev. *E. baratum* Elmer, Bot. Gaz. 39: 52 (1905), type loc. betw. Griffin and Mt. Pinos, *Elmer* 3593.

19. **E. deflexum** Torr. Skeleton Weed. (Fig. 76.) Stems 1 or several from the base, glabrous and green, 5 to 13 inches high, divaricately branched, the internodes short and branching, intricate, or sometimes simpler with elongated branchlets; leaves in a basal rosette, round-obcordate, whitish tomentose, ½ to 1½ inches long, the petioles half to twice as long; involucre campanulate or broadly turbinate, ½ to 1 line long, with 4 short broad obtuse lobes, on pedicels ¼ to 1 (or rarely 2) lines long, more or less deflexed; calyx white, or turning pink, glabrous, ½ to 1 line long, the outer segments elliptic or elliptic-ovate, very obtuse, cordate at base, the inner narrowly ovate-acuminate, shorter than the outer, half as wide.

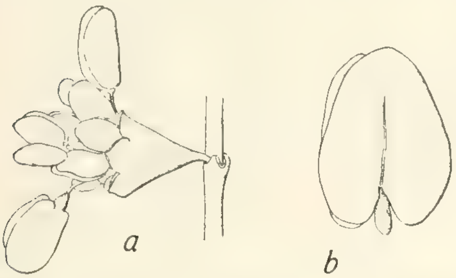

Fig. 76. Eriogonum deflexum Torr. *a*, involucre, x 5; *b*, flower, x 10.

Desert washes and flats, Colorado and Mohave deserts north to Inyo Co. Nevada, Arizona.

Locs.—Caleb, *Parish* 8290; Calexico, *Abrams;* Chuckawalla Mts., *Mrs. F. Stephens;* Palo Verde Valley, *Hall* 5953; Riverside Mts., *Jepson* 5235; Victor, *Jepson* 5613.

Refs.—Eriogonum deflexum Torr. in Ives, Rep. Colo. River, Bot. 24 (1860), type loc. Three Point Bend, Chocolate Mts., Colorado River, *Newberry*. *E. brachypodum* T. & G. Proc. Am. Acad. 8: 180 (1870), type loc. Kingston Spr., Kingston Mts., *Remy;* differs only in being slightly glandular hairy; ranges into southern Nev. Various Californian specimens in Californian herbaria are labeled as *E. hookeri* Wats. (Proc. Am. Acad. 14: 295,—1879, type locs. Wahsatch Mts. and w. Nev.), as *E. insigne* Wats. (Proc. Am. Acad. 14: 295,—1879, type loc. Red Creek, s. Utah, *Palmer* 431 in 1877), or as *E. parryi* Gray (Proc. Am. Acad. 10: 77.—1874, type loc. s. Utah, *Parry* 239). This Californian material is, however, not sufficiently distinguishable by the diagnoses referred to and we must at this time regard the specimens in question as variants of E. deflexum.

II.—Subgenus **Oregonium.**

Involucres cylindric or cylindric-turbinate, 5-toothed, 5 or 6-nerved or angled, always sessile, solitary or congested in heads, always erect; bracts on the flowering branches in 3s, connate at base; calyx not at all or little accrescent, not stipe-like at base; ovary and filaments mostly glabrous; annuals, perennial herbs, or shrubs; mostly of deserts or arid foothills.

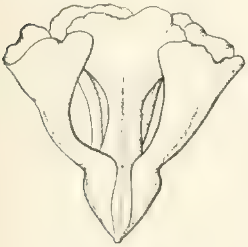

Fig. 77. Eriogonum nidularium Cov.; flower, x 12.

20. **E. nidularium** Cov. (Fig. 77.) Stems 1 or many from the base, repeatedly and regularly dichotomous, the forks short, making a dense mass of intricate branches which in well-grown plants curve in at maturity and suggest resemblance to a bird's nest; whole plant cobwebby-tomentose, often reddish in age, 3 to 8 inches high; leaves roundish ovate to orbicular and subcordate, 3 to 6 lines long, the petioles 1 to 2½ times as long; involucres sessile in all the forks and along the branches, ½ line long; calyx red, white or yellowish, glabrous, ¾ to 1 line long; outer segments somewhat quadrate, dilated at the truncate apex, the sides incurved; inner segments similar but narrower; ovary glabrous, scabrous on upper part.

Desert area: San Bernardino and Inyo cos. Nevada.

Locs.—Victor, *Jepson* 5620; Barstow, *Jepson* 4836, 5391; Lanfair, *Maye L. Tennent;* New York Mts., *Connor;* Lone Pine Creek, *Hall & Chandler* 7197; White Mts., *Heller* 8306.

Plants 6 to 8 inches high often develop 15 to 25 stems from near the base, which fork and refork 4 to 10 times and produce 1000 to 1200 terminal branchlets. As the forks grow they become intricately interlocked and it is impracticable to divide the plant except by tearing it forcibly apart.

Refs.—Eriogonum nidularium Cov. Contrib. U. S. Nat. Herb. 4: 186 (1893), type loc. Panamint Mts., *Coville* 963. *E. plumatella* of Bot. Cal. 2: 31 (1880).

21. **E. gracile** Benth. Stems strictly branched and forming a narrow panicle or more diffuse, ½ to 2½ feet high; thinly tomentose throughout, becoming floccose; leaves oblanceolate or broadly oblong, attenuate to a slender petiole, ½ to 2 inches long, tomentose on both sides or less so above; bracts more or less elongated, equaling nearly or quite the involucres, or the lower somewhat foliaceous; involucres along the elongated branches, glabrous or nearly so, barely exceeding the bracts and half concealed by them, ¾ to 1 line long, cylindric-campanulate, the teeth acute, prominent, spreading; calyx white, rose-color or yellowish, glabrous, ¾ line long.

Dry plains, valleys and low hills. Great Valley and Coast Ranges to Southern California. Lower California.

Locs.—Witch Creek, *Alderson;* Riverside, *Zumbro;* San Bernardino, *Parish* 3822; Los Angeles, *E. D. Palmer;* Antelope Valley, *Lyell;* Soledad, *Congdon;* Lathrop, *K. Brandegee;* Vaca Mts., *Jepson.*

Refs.—ERIOGONUM GRACILE Benth. Bot. Sulph. 46 (1844), type loc. San Pedro, *Hinds;* Jepson, Fl. W. Mid. Cal. 154 (1901). *E. agninum* Greene, Pitt. 2: 165 (1891), type loc. Santa Inez Mts., n. slope.

22. **E. citharaeforme** Wats. Stems 1 or several from the base, freely branching, 1 to 3 feet high; herbage thinly tomentose, glabrous or glabrate above; leaves in a basal rosette, or a few at the lower nodes, roundish to ovate, ¾ to 2 inches long, gradually or cordately contracted to a long winged petiole, the wing crenulately toothed, attenuate downward; involucres turbinate, 1½ lines long.

San Luis Obispo Co. east to the inner South Coast Ranges. A local and indefinitely known species. Perhaps only a variety of E. virgatum.

Ref.—ERIOGONUM CITHARAEFORME Wats. Proc. Am. Acad. 23: 266 (1888), type loc. Baron Schroeder's Ranch, Santa Margarita, *Lemmon* 1584.

23. **E. virgatum** Benth. Tomentose throughout, stem slender, erect, simple, or the few branches rather strict, 1 to 3 feet high; leaves in whorls on lower part of stem or rosulate at the base, oblanceolate (or obovate), ½ to 2 inches long, on slender petioles, the margin usually undulate; involucres 2 to 2½ lines long, rather remote, tomentose, cylindric, truncate or nearly, the teeth minute; bracts lanceolate, shorter than the involucres; calyx glabrous, 1 line long, white, buff, sulphur-yellow or pink.

Stream beds: Coast Ranges; Sierra Nevada, 500 to 5000 feet.

Locs.—Quartz Valley, Siskiyou Co., *Butler* 203; Hy-am-pum, *Chesnut & Drew;* Middle Creek, Lake Co., *Tracy* 2358; Cloverdale, *Jepson;* Putah Creek, *Jepson;* Walnut Creek, *Jepson;* Los Buellis Hills, Santa Clara Co., *R. J. Smith;* New York Falls, Amador Co., *Hansen* 163; San Andreas, *Jepson;* Crockers, Yosemite Park, *Jepson* 4636; Coulterville, *Jepson;* Redwood Cañon, E. Fork Kaweah River, *Jepson* 1159; S. Fork Kaweah River, *Culbertson* 4404; Upper Grouse Valley, Tulare Co., *Jepson* 4707; Tehachapi, *Stokes;* Griffin, Ventura Co., *Hall* 6335.

Refs.—ERIOGONUM VIRGATUM Benth. in DC. Prodr. 14: 16 (1856), type from California, *Fremont.* *E. roseum* Dur. & Hilg. Pac. R. Rep. 5^3: 14, pl. 15 (1855), type loc. Posé Creek, Kern Co., *Heermann;* lower nodes of panicle leafy; flowers rose-red.

24. **E. molestum** Wats. Habit of E. vimineum, glabrous and glaucous above the white-woolly leaves; leaves roundish or cordate, crisped or undulate, 4 to 6 lines long; flowers white, ¾ to 1 line long; involucres cylindric-turbinate, 2½ lines long; ovary scaberulous.

San Gabriel, San Bernardino and San Jacinto mountains to San Diego.

Var. **davidsonii** Jepson n. comb. Habit and foliage of E. molestum but involucres only 1¾ lines long, cylindric-prismatic; bracts more united and cup-like.—San Gabriel Mts. to the San Jacinto Mts.

Refs.—ERIOGONUM MOLESTUM Wats. Proc. Am. Acad. 17: 379 (1882), type spms. from mountains of S. Cal. Var. DAVIDSONII Jepson. *E. davidsonii* Greene, Pitt. 2: 295 (1892), type loc. Wilson Peak, *Davidson.*

25. **E. vimineum** Dougl. (Fig. 78b.) Stems 1 or several, glabrous wholly or at least above the base, erect, 3 to 18 inches high, much branched from

near the base, the branches elongated and virgate, with the lower often in whorls of 3 to 5; lower forks sometimes leafy; leaves orbicular to broadly ovate, 3 to 12 lines broad, greenish, reddish, or yellowish, white tomentose below, the margin undulate, at least in age, the petioles 1 to 3 times as long; involucres very narrow, cylindric, strongly angled, 1 to 1½ lines long; flowers rather few, rose-color, or yellowish, glabrous, 1 line long; outer calyx segments obovate, rounded at apex, the inner oblong.

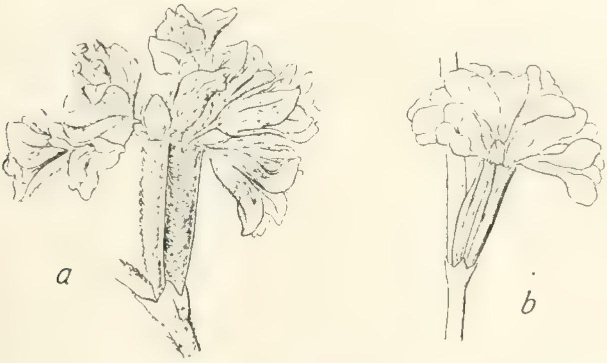

Fig. 78. *a*, ERIOGONUM DASYANTHEMUM T. & G.; involucre. *b*, E. VIMINEUM Dougl.; involucre, x 5.

Coast Range hills, especially slopes near rocky outcroppings.

Locs.—Napa Valley, *Jepson* 2976; Howell Mt., *Brandegee;* Mt. St. Helena, *Jepson;* Blue Lakes, Lake Co., *Jepson;* Mt. Konocti, *Jepson;* Willow Creek, Humboldt Co., *Tracy* 3451; Shasta Sprs., *Jepson;* Yreka, *Butler* 1572; Scott Valley, Siskiyou Co., *Jepson* 2957; Dixey Valley, Lassen Co., *M. S. Baker;* Belden, Feather River, *Jepson* 4151; Ione, *Braunton* 1166.

Var. **elegans** Jepson n. comb. Stem for a half-inch at base densely clothed with white-woolly obcordate small leaves; involucres turbinate; calyx rose-red or whitish, ½ line long.—San Luis Obispo Co.

Var. **caninum** Greene. Stems several from the base, procumbent or very diffuse, repeatedly di- or at first tri-chotomous, with short forks and branchlets, or the stem sometimes solitary, erect and branching only at the first node; inflorescence and stems reddish; involucres narrowly turbinate, mostly at the ends of the short branches or sessile in the forks; calyx rose-red.—Oakland Hills; Marin Co.; Monterey Co.

Refs.—ERIOGONUM VIMINEUM Dougl.; Benth. Trans. Linn. Soc. 17: 416 (1837), type from the Columbia River, *Douglas.* Var. *californicum* Gand. Bull. Soc. Roy. Bot. Belg. 42: 199 (1905), type loc. Petaluma, *Tidestrom.* *E. luteolum* Greene, Pitt. 3: 200 (1897), type loc. Napa Valley, *Greene.* Var. ELEGANS Jepson. *E. elegans* Pitt. 2: 173 (1891), type loc. upper Salinas River, *A. Norton.* Var. CANINUM Greene, Fl. Fr. 150 (1891), type loc. Tiburon, *Greene.* *E. nortoni* Greene, Pitt. 2: 165 (1891), type loc. Gonzales, Monterey Co., *A. Norton.*

26. **E. baileyi** Wats. Diffusely branched from the base, glabrous, 5 to 12 inches high, and half again as broad, with something of the delicate or slender habit of E. gracile; leaves roundish to ovate, white-woolly; involucres cylindric or a little enlarged upwards, ½ to ⅞ line long; calyx lemon yellow or whitish, delicately glandular, ⅔ line long; outer segments ovate or oblong, the inner smaller, narrowly ovate; body of achene lenticular, strongly beaked. Desert valleys: Mohave Desert north to Inyo Co. and western Nevada; Arizona to Washington.

Var. **brachyanthum** Jepson n. comb. Stems usually greenish rather than pale or glaucous, at base with a persistent lanate zone; internodes shorter and relatively stouter; bracts redder; calyx glabrous in age, usually constricted a little at middle and flaring at tip, as often in the species.—Mohave Desert north to Inyo Co. Well-grown plants recall in miniature the habit of a Texas Umbrella Tree.

Locs.—Victor, *Jepson* 5614; Barstow, *Jepson* 5241; Olancha, *Jepson* 5131; Alabama Hills, *Jepson* 915; Cottonwood Creek, *Purpus* 3034; Indian Wells, *Purpus* 3030.

Var. **tomentosum** Wats. Stems thinly tomentose.—San Bernardino Mts. Of doubtful affinity.

Refs.—ERIOGONUM BAILEYI Wats. Proc. Am. Acad. 10: 348 (1875), type spms. from desert valleys east of the Sierra Nevada. Var. BRACHYANTHUM Jepson. *E. brachyanthum* Cov. Contrib. U. S. Nat. Herb. 4: 185 (1893), type loc. Indian Wells, Inyo Co., *Coville*. Var. TOMENTOSUM Wats. Proc. Am. Acad. 12: 268 (1876).

27. **E. dasyanthemum** T. & G. (Fig. 78a.) Stems thinly tomentose or soon glabrate, 1 to 2 feet high, branching from or near the base, and often bush-like in habit; leaves roundish, plane, tomentose below, less so above, ½ to 1½ inches long, abruptly contracted to a slender petiole half to as long; involucres 1 or 2 in a place, rather remote, cylindric, 2 lines long, tomentose between the callous ribs; calyx white or red, 1 line long, densely hairy on outside, glabrous inside; filaments glabrous or slightly pubescent at very base.

Low dry hills, inner Coast Range from the Vaca Mts. to Lake Co. and north to the Yollo Bollys. Sept.-Nov. This seems quite to replace E. vimineum of the middle North Coast Range..

Locs.—Vaca Mts., *Jepson*; Knoxville grade, *Jepson*; Guinda, *Rowena Beans*; Sulphur Bank, Lake Co., *Agnes Bowman*; Yollo Bolly, *Brandegee*.

Refs.—ERIOGONUM DASYANTHEMUM T. & G. Proc. Am. Acad. 8: 177 (1870), type loc. Clear Lake, *Bolander, Torrey*. Var. *jepsonii* Greene, Fl. Fr. 150 (1891), type loc. Gates Cañon, Vaca Mts., *Jepson* in 1887.

28. **E. mohavense** Wats. Stems 1 or several from the base, repeatedly tri- and di-chotomously branched, 4 to 12 inches high, glabrous or a little hairy at the nodes; branches green, bracts often red; leaves in a rosulate basal cluster, roundish or ovate, 2 to 6 lines long, abruptly narrowed to a slender petiole; involucres turbinate-bellshaped, very shortly 5-toothed, glabrous outside, a hairy ring inside at throat, ¾ line long, sessile in the forks and terminal on the short branchlets; calyx yellow, glabrous, ½ line long, the outer segments oblong or elliptic, the inner segments sometimes white, half as broad; achene partly exserted.

Dry hills, Mohave Desert. Involucres almost flaring just at mouth. Remarkable for the small size of its flowers.

Locs.—Lancaster, *K. Brandegee*; Kramer, *Jepson* 5321, 5337; Barstow, *Jepson* 4818; Indian Wells, *Hall & Chandler* 7367.

Refs.—ERIOGONUM MOHAVENSE Wats. Proc. Am. Acad. 12: 266 (1877), type loc. Mohave Valley, *Palmer*. *E. delicatulum* Wats. Proc. Am. Acad. 17: 379 (1882), type loc. Mohave Desert, *Parry*; "Resembling E. mohavense but smaller and more slender, with narrower and less strongly nerved involucres and the achenes exserted."—Not known to us.

29. **E. truncatum** T. & G. Stems mostly several from the base, thinly tomentose or glabrate, 6 to 15 inches high, naked, bearing a leafy-bracted irregular umbel; leaves obovate or oblong-oblanceolate, with undulate margin, 1 to 2 inches long, attenuate to a slender petiole nearly as long; umbel of 3 to 6 elongated unequal rays loosely once or twice di- or tri-chotomous; bracts almost minute; involucres 2 to 4 in a cluster or solitary, tomentose, oblong-turbinate, 2 lines long; calyx light rose-color, glabrous, 1⅓ lines long; filaments pubescent at very base.

East base of Mt. Diablo north to Antioch. The sinuses between the involucral teeth are completely filled by a membrane so that the involucre is truncate.

Var. **adsurgens** Jepson n. comb. (E. adsurgens Stokes in hb.) Leaves roundish, 5 to 11 lines broad, abruptly long-petioled; involucres turbinate, 1 line long, obviously toothed.—(Folia suborbicularia, lin. 5-11 lata, abrupte longo-petiolata; involucra turbinata, linea longa, subdentata.)—Inner South Coast Range from Warthan, *Eastwood*, May 11, 1893, type, to Hernandez, *Eastwood*.

Ref.—ERIOGONUM TRUNCATUM T. & G. Proc. Am. Acad. 8: 173 (1870), type loc. Mt. Diablo, *Brewer*. The exact station for the type is "Dry hillsides at Marsh's Ranch" at east base of Mt. Diablo (see type sheet in Gray Herbarium) and not "summit of the eastern peak."

30. **E. saxatile** Wats. Flowering stems erect, naked, paniculately 1 or 2-forked, tomentulose, ¼ to 1 (or 2) feet high, arising from a woody caudex; caudex simple or branched, 2 to 5 inches high, densely crowded or even imbricated with leaves; leaves covered with a dense silvery felt, roundish to round-ovate, shortly acute, ¼ to 1 (or 1½) inches long, shortly petioled; involucres tomentulose, 1½ to 2 lines long, scattered along the branches of the panicle; calyx white or pale yellowish, glabrous, 3 to 4 lines long, gradually narrowed to a stipe-like 3-angled or 3-carinate base as long as the segments; inner calyx segments obovate, rather exceeding the narrower outer ones; filaments hairy at very base.

Mountain sides, 3000 to 8500 feet: Southern California, north in the Sierra Nevada to the Kaweah River and in the Coast Ranges to the Santa Lucia Mts.

Locs.—Mt. San Jacinto, *Hall* 2324; San Bernardino Mts. (Little Bear Valley), *Hall* 1005, 1294; Pahute Peak, *Purpus* 5325; Kernville and Sequoia Mills, *Brandegee;* Big Arroyo, Kern River, *Jepson* 4989; Santa Lucia Mts., *Jepson* 4737; Mt. Hamilton (Erythea, 1:84).

Refs.—ERIOGONUM SAXATILE Wats. Proc. Am. Acad. 12: 267 (1877), type specimens from San Bernardino Mts., *Parry*, and Santa Lucia Mts., *Palmer*. Var. *bloomeri* Wats.; Parish, Erythea, 6: 88 (1898), type loc. San Bernardino Mts., *Parish* 1664, 3785; *E. bloomeri* Parish, l. c. 87. *E. stokesiae* Jones, Contrib. 8: 39 (1898), type loc. Pleasant Cañon, Panamint Mts., *Jones.*

31. **E. elongatum** Benth. Flowering stems erect, slender, leafless, simple or strictly branching, 1 to 4 feet high, arising from a branching base composed of leafy stems 3 to 9 inches high; herbage whitish-tomentulose throughout, the leaves beneath densely white-tomentose, above glabrate; leaves scattered or congested, ovate to oblong-lanceolate, acute, the margin undulate, 1 to 1½ inches long, narrowed to a short petiole; involucres remotely scattered along the elongated stems or branches, cylindric, 3½ lines long, truncate or obscurely toothed; calyx white, glabrous save a little hairiness on midveins inside, 1½ lines long, its segments obovate, obtuse, the inner slightly longer than the outer; filaments glabrous.

Mountain sides and cañons near the coast from Monterey Co. to San Diego and east to Banning. Lower California.

Locs.—San Bernardino, *Parish* 4203; Claremont, *Elizabeth Palmer;* Leonis Valley, *Davy;* Santa Lucia Mts., *Jepson* 2588 (Big Sur River), 4736 (Santa Lucia Peak).

Ref.—ERIOGONUM ELONGATUM Benth. Bot. Sulph. 45 (1844), type loc. San Pedro.

32. **E. wrightii** Torr. Flowering stems several, 4 to 12 inches high, arising from a much-branched woody base with erect very leafy short branches; leaves obovate or oblanceolate, acute, white-tomentose, 2 to 6 lines long, short-petioled, often with smaller ones fascicled in the axils, or the lowermost twice as long with longer petioles; peduncles short, once or twice di- or trichotomous, the branches erect and rather strict; involucres scattered along the branches or congested towards the ends, campanulate-tubular, prominently but obtusely angled and woolly between the angles; calyx white or pink, 1½ lines long, its segments obovate, rounded at apex, the inner longer than the outer.

Stream beds or mountain slopes: Sierra Nevada, Coast Ranges towards the interior, and Southern California. East to Texas.

Locs.—Putah Creek, *Jepson;* Corral Hollow, *Brewer* 846; Donner Lake, *Heller* 7165; between Glenbrook and Carson, *K. Brandegee;* Silliman Creek, Tulare Co., *K. Brandegee;* Soda Cañon, Sawtooth Range, *Jepson* 1112; Little Kern, *Purpus* 2099; Lanfair, Mohave Desert, *Maye L. Tennent.*

Var. **subscaposum** Wats. Leafy branches short, forming a close dense mat with short flowering stems; calyx smaller, with the segments less narrowed at base.—High montane.

Locs.—Mt. San Jacinto, *Hall* 816; San Bernardino Mts., *Blasdale*; Antimony Mt. near San Emigdio, *Brandegee;* Mineral King, *Brandegee;* Sequoia Park, *Fry;* S. Fork San Joaquin River, *Hall & Chandler* 639; Sentinel Dome, Yosemite, *Jepson* 5647; Donner Lake, *Heller* 7165.

Var. **membranaceum** Stokes in hb. Petioles dilated at base into a sheath clasping the stem; leaves glabrate above; sheaths soon glabrate, ½ to 1 line long.—(Petiolata basi ochreata; ochreae glabrescentae, lin. ½-1 longae; folia supra glabra.)—Southern California mountains.

Locs.—Julian, *Dunn;* Cuyamaca Peak, *Brandegee;* Mt. San Jacinto, *Vanderventer.*

Refs.—ERIOGONUM WRIGHTII Torr.; Benth. in DC. Prodr. 14: 15 (1856), type w. Texas, *Wright.* *E. trachygonum* Torr. in DC. Prodr. 14: 15 (1856), type coll. in California by Wilkes Exped.; Jepson, Fl. W. Mid. Cal. ed. 2, 133 (1911). *E. wrightii* var. *trachygonum* Jepson, Fl. W. Mid. Cal. 154 (1901). Var. SUBSCAPOSUM Wats. Bot. Cal. 2: 29 (1880). *E. curvatum* Small, Bull. Torr. Club, 25: 50 (1898), type loc. Long Mdw., Tulare Co., *Dr. Palmer* 207. *E. junceum* Greene, Leaflets, 1: 77 (1904), type loc. Kern Cañon, *Culbertson* 4396, the wire-like peduncles and the involucres soon glabrate but not otherwise different.

33. **E. nodosum** Small. Stems several from the base, tri- or di-chotomously branching, leafy below, ¾ to 1¼ (or "3½") feet high, white-tomentulose; involucres turbinate-cylindric, 1½ lines long, sessile and unilaterally crowded on the ultimate (½ to 1 inch long) branchlets or pedicellate in the forks; calyx glabrous, 1½ lines long, parted about half-way, the base coriaceous; outer segments roundish, notched at apex, the inner similar, half as broad; filaments pilose below the middle; achene minutely scaberulous.

Desert region: White Mts., Inyo Co.; Imperial Co. Nevada; Lower California.

Ref.—ERIOGONUM NODOSUM Small, Bull. Torr. Club, 25: 49 (1898), type loc. Dos Cabezas (near Coyote Well, Colorado Desert), *Orcutt* 1462.

34. **E. heermannii** Dur. & Hilg. Stems woody at base, leafy below, soon branching into a panicle, 1½ to 2 feet high; peduncle of the panicle short, repeatedly 2 or 3-forked and finally ending in somewhat spinescent branchlets; forks of the panicle rather short but straightish, rigid, somewhat divaricate, as if fistulous and a little constricted at the joints; plant flocculent or glabrate on lower part, glabrous above; leaves oblong, 6 to 8 lines long, petioled; involucres hemispherical or broadly turbinate, 1 line long, the broad rounded lobes scarious-margined and overlapping at the sinuses; calyx 1 to 1¼ lines long, glabrous, the outer segments orbicular, the inner oblong, much narrower.

Mohave Desert northward to the southern Sierra Nevada and west to Mt. Pinos, *Hall* 6737. Nevada.

Ref.—ERIOGONUM HEERMANNII Dur. & Hilg. Pac. R. Rep. 5^3: 14, pl. 17 (1885), type loc. Posé Creek, Kern Co., *Heermann.*

E. SULCATUM Wats. Proc. Am. Acad. 14: 296 (1879). Very similar; branches of the panicle angular, minutely scabrous.—Utah; Nev. To be looked for in the Death Valley region. Cf. var. argense Jones, Contrib. 11: 15 (1903), type loc. Argus Mts.

35. **E. plumatella** Dur. & Hilg. Stems woody at base, 1 to 2 feet high, the branches straightish or zig-zag, covered with a dense thin tomentum; forks (or internodes) of the panicle short, somewhat curved, continuously divaricate so that the inflorescence eventually appears almost contorted; involucres narrowly campanulate, glabrous outside, the teeth pubescent inside, not scarious margined; calyx white or pinkish, ⅔ line long; outer segments obovate, truncatish, inner obovate, rounded or subacute, all cuneate at base; filaments a little hairy at base; beak of the ovary 3-angled, roughish.

Southern Sierra Nevada (Walker Pass acc. *Coville*) and south into the Mohave Desert (Lanfair, *Maye L. Tennent*). Flowers in rather small and compact clusters towards the ends of the rather long panicle branches.

Refs.—ERIOGONUM PLUMATELLA Dur. & Hilg. Pac. R. Rep. 5^3: 14, pl. 16 (1855), type loc. Posé Creek, Kern Co., *Heermann;* Cov. Contrib. U. S. Nat. Herb. 4: 187 (1893). *E. palmeri* Wats. Proc. Am. Acad. 12: 267 (1877), type spms. from Julian and San Felipe in San Diego Co. and s. Utah, *Palmer.*

36. **E. microthecum** Nutt. Stems woody at base, diffusely but shortly branched, 4 to 10 inches high, whitish tomentulose throughout or the leaves above and the stems and involucres glabrate; leaves oblong-spatulate to elliptic, sometimes revolute, 4 to 8 lines long, shortly petioled; peduncles 1 to 4 inches long, bearing a small cymosely branched compound umbel; involucres sessile, those in the axils pedicellate, narrowly campanulate, 1½ lines long, shortly toothed; calyx white, pink or yellow, glabrous, 1 to 1½ lines long, its lobes about equaling the tube; outer lobes round, often subcordate at base, the inner lobes elliptic.

Eastern slope of the Sierra Nevada, 5000 to 10,000 feet. North to Washington, east to the Rocky Mts.

Locs.—Sonora Pass, *Brewer* 1888; Mono Pass, *Bolander* 6356; White Mts., *Purpus* 6424 (flowers yellow = var. aureum Stokes); Cottonwood Creek, Inyo Co., *Purpus* 1919; Bear Valley, San Bernardino Mts. acc. *Parish.*

Refs.—ERIOGONUM MICROTHECUM Nutt. Jour. Acad. Phila. ser. 2. 1: 162 (1848), type loc. hills east of Walla Walla, *Nuttall;* Parish, Zoe, 4: 166 (1893). *E. effusum* Nutt. l. c. 164, type loc. northern Rocky Mts., *Nuttall.* *E. confertiflorum* Benth. in DC. Prodr. 14: 17 (1856), type loc. Shasta River, Wilkes Exped.

E. CORYMBOSUM Benth. in DC. Prodr. 14: 17 (1856), type loc. Grand River, *Fremont.* Watson (Bot. Cal. 2: 28) and Coville (Contrib. U. S. Nat. Herb. 4: 186) cite this species as occurring on the eastern slope of the Sierra Nevada, but all Sierran specimens seen by us are referable to E. microthecum.

37. **E. arborescens** Greene. Shrubby, several feet high, the trunk 3 to 4 inches thick; leaves crowded at the ends of the many branchlets, linear or oblong, strongly revolute, white-tomentose beneath, glabrate above, ½ to 1¼ inches long; peduncles stout, bearing a large compound cyme, the involucres in capitate clusters; calyx rose-color, densely white-villous at base.

Santa Barbara Islands: Santa Cruz; Anacapa; Santa Rosa.

Ref.—ERIOGONUM ARBORESCENS Greene, Bull. Cal. Acad. 1^1: 11 (1884), type loc. Santa Cruz Island, *Kellogg & Harford.*

38. **E. giganteum** Wats. Freely branching shrub 2 to 8 feet high, bearing its white foliage towards the ends of the tomentose or glabrate branches; trunk with rough bark, 1 to 4 inches in diameter; leaves leathery, ovate, obtuse, 1 to 2½ inches long, white-lanate on both sides or glabrate above, strongly veined beneath, the petioles ½ to 1 inch long; peduncles stout, bearing a dense tri- or di-chotomously branched compound cyme 2 to 12 inches broad; involucres sessile or pedicellate, somewhat crowded on the branchlets, campanulate with very low teeth, almost as if truncate, 2 lines long, densely close woolly outside; calyx 1 line long, densely white-hairy toward the cuneate base, its segments broadly obovate, rounded at apex, the inner narrower; filaments pubescent at base.

Santa Barbara Islands: Santa Catalina; San Clemente; Santa Cruz.

Refs.—ERIOGONUM GIGANTEUM Wats. Proc. Am. Acad. 20: 371 (1885), type loc. Santa Catalina Isl., *W. S. Lyon.* Var. FORMOSUM K. Brandegee, Erythea, 5: 79 (1897), type loc. San Clemente Isl., *T. S. Brandegee;* leaves oblong lanceolate.

39. **E. cinereum** Benth. Shrub 2 to 5 feet high, the stems tomentulose; leaves ovate, puberulent above, obtusish, the larger abruptly short-cuneate at base, undulate, thinly gray-tomentose beneath, ½ to 1¼ inches long, short-petioled; peduncles elongated, sparingly dichotomous, the heads few and scattered in the forks; involucres tomentulose, 1½ to 2 lines long, with 5 triangular teeth; calyx densely silky outside, its segments narrowly obovate, obtuse, 1½ lines long; filaments glabrous.

Bluffs and foothills along the coast: Santa Barbara to Santa Monica and San Pedro.

Ref.—ERIOGONUM CINEREUM Benth. Bot. Sulph. 45 (1844), type loc. San Pedro.

40. **E. parvifolium** Smith. Shrub 1 to 3 feet high, or woody only at base; branches densely leafy with fascicled leaves; leaves thick, oblong-lanceolate

to ovate or roundish, undulate and irregularly revolute-margined, truncatish or subcordate at base, dark green and glabrate above, white with a dense felt beneath, 2 to 6 lines long, shortly petioled; peduncles short, simple or umbellately 2 or 3-forked, bearing terminal or racemosely scattered heads of involucres, the heads few, compact, also sessile in forks when the inflorescence is umbellate; involucres 2 lines long, glabrate outside, densely woolly on inside at throat; calyx white, glabrous, 1½ to 2 lines long, its segments obovate, the outer obtuse, the inner slightly broader and retuse; filaments a little hairy at base.

Sand-dunes and hillsides near the coast; Monterey Bay to Southern California.

Locs.—Santa Cruz, acc. *Anderson;* Pt. Pinos, Monterey, *Jepson;* Carmel Mission, *Jepson;* Little Sur, *Jepson* 2604; Oceanside, *Parish* 4445; Carlsbad, *Alderson.*

Ref.—ERIOGONUM PARVIFOLIUM Smith in Rees, Cycl. 13 (1819), the type from California, *Menzies.*

41. **E. fasciculatum** Benth. FLAT-TOP. "WILD BUCKWHEAT." Woody at base, 2 to 3 feet high, with shreddy bark; branches very leafy, ending in a mostly short (1 to 3 inches) peduncle bearing the inflorescence; involucres in capitate clusters or heads; heads terminal on the unequal rays or sessile in the forks of a simple or compound umbel, or the umbel reduced and capitate; rays 1 to 4 inches long; bracts linear; leaves oblong, linear or oblanceolate, revolute margined, 4 to 8 lines long, drawn down to a narrow base, densely white-woolly below, usually green and glabrate above; involucres 2 lines long, with short acute teeth; calyx white, glabrous, 1¼ to 1¾ lines long, the outer segments elliptic, the inner obovate and narrower, all rounded at apex; filaments glabrous or nearly so.

Abundant on mesas and mountain slopes from Monterey Co. to Southern California. It is generally known as "Wild Buckwheat" and is the third most valued native bee-plant after White Sage and Black Sage. The typical form described above, with glabrous flowers, is confined to the sea-coast from Santa Barbara to San Diego. The two dominant mesa forms are the following varieties.

Var. **foliolosum** Stokes. Peduncles long (4 to 10 inches); leaves more strongly revolute-linear, green but pubescent above, tomentose beneath; calyx slightly hairy outside.—Chaparral slopes, the abundant form: Santa Barbara to San Diego and east to San Bernardino and Temescal.

Var. **polifolium** T. & G. Peduncles long; foliage gray, the leaves commonly less revolute, hoary above, tomentose below; calyx often conspicuously hairy outside, especially towards the base.—Desert slopes of the mountains in the Colorado and Mohave deserts west to Palomar; north to Bakersfield and Inyo Co., east into Nevada.

Refs.—ERIOGONUM FASCICULATUM Benth. Trans. Linn. Soc. 17: 411 (1837), types from California, *Menzies, Douglas. E. aspalathoides* Gand. Bull. Soc. Roy. Bot. Belg. 42: 189 (1905), type loc. Los Angeles. Var. *maritimum* Parish, Muhl. 3: 59 (1907), type loc. Oceanside, *Parish* 4445. Var. FOLIOLOSUM Stokes; Abrams, Bull. N. Y. Bot. Gard. 6: 351 (1910). *E. rosmarinifolium* Nutt. Jour. Phila. Acad. ser. 2, 1: 164 (1848), type loc. Santa Barbara, *Nuttall.* Var. *foliolosum* Nutt. l. c. 165, type loc. Santa Barbara, *Nuttall.* Var. *oleifolium* Gand. Bull. Soc. Roy. Bot. Belg. 42: 189 (1905), San Diego. Var. POLIFOLIUM T. & G. Proc. Am. Acad. 8: 169 (1870). *E. polifolium* Benth. in DC. Prodr. 14: 12 (1856), based on *Fremont,* Sierra Nevada (probably near Tehachapi), and *Parry,* San Diego.

42. **E. latifolium** Smith. Flowering stems from a densely leafy caudex, stout, tomentulose, naked, ½ to 2 feet high, 2 to 4-forked above, the forks simple or again forked; involucres in capitate clusters, terminal and sessile in the forks, or the whole inflorescence often reduced to a single large head or with one proliferous branch from under the first head; leaves ovate to oblong, obtuse or acute, at base rounded or cordate, rarely cuneate, often

undulate, densely white-woolly or lanate, or glabrate above, 1 to 2½ inches long, the petioles short or long; involucres tomentose, 2 lines long; calyx glabrous, white or light rose-color, 1½ lines long; filaments woolly at base.

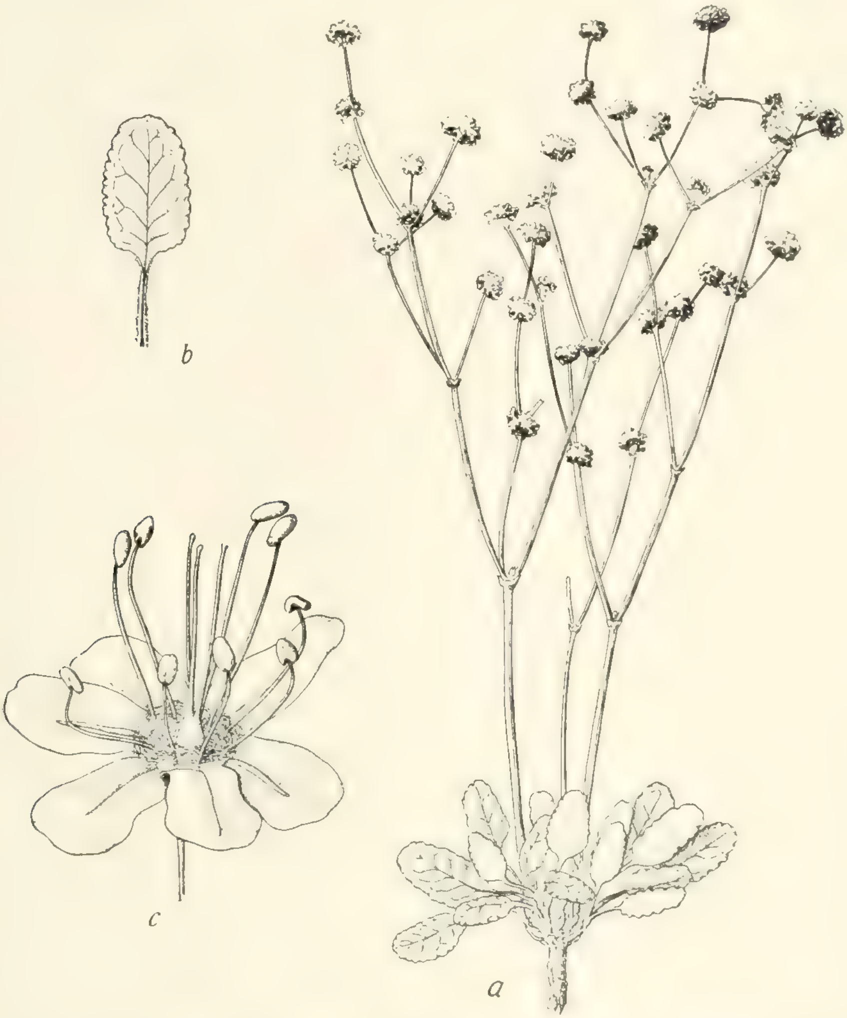

Fig. 79. ERIOGONUM NUDUM Dougl. *a*, habit, x ¼; *b*, leaf, x ½; *c*, flower, x 8.

Rocky cliffs or sandy places along the sea-coast from Humboldt Co. to Southern California.

Locs.—Ano Nuevo Point, *Jepson* 4167; San Francisco, *Leila Hibbard;* Bodega Pt., *Eastwood;* Pt. Reyes, *Jepson* 1176; Humboldt Bay, *Tracy* 1205 (the inner calyx segments slightly hairy on back).

Ref.—ERIOGONUM LATIFOLIUM Smith in Rees, Cycl. 13 (1819), the type from California, *Menzies.*

43. **E. nudum** Dougl. TIBINAGUA. (Fig. 79.) Tall and slender, 1 to 3 feet high, the stems glabrous, peduncle-like, often fistulous, sometimes inflated, branching into a usually large panicle, the leaves all at base on the short woody caudex; leaves broadly ovate or oblong, obtuse, cordate or abruptly

cuneate at base, undulate, densely tomentose beneath, glabrate above, 1 to 2 inches long, on slender petioles; involucres 2 or 3 lines long, glabrous or nearly so, 2 to 6 in each cluster; calyx glabrous, at least outside, 1 to 1½ lines long, usually white, sometimes rose-color or yellow; filaments a little hairy at base.

Throughout California, very common on dry hills, valley flats or mountain slopes in the Coast Ranges and Sierra Nevada. Oregon. July-Oct.

Locs.—Shasta Co., *Jones & Alexander;* Willow Creek, Humboldt Co., *Tracy* 3294; Bartletts, Lake Co., *K. Brandegee;* Petaluma, *E. Palmer;* Hackberry Cañon, Caliente, *K. Brandegee;* Tehipite, *Hall & Chandler* 514; Yosemite, *Jepson* 5661; Little Yosemite, *Jepson* 3152; Rancheria Mt., *Jepson* 4610.

Eriogonum nudum is an inconstant species and many specific segregates of it have been published, the diagnoses leaning most heavily on two variable characters, namely the degree of branching of the inflorescence and the degree of hairiness. The acceptance of these specific segregates would, however, require the naming of many forms still unnamed and necessitate a still greater refinement of obviously inconstant characters. We are therefore disposed to arrange the more well-known forms as varieties.

Var. **deductum** Jepson n. comb. Stems many from the base, 5 to 13 inches high, umbellately trichotomous above, glabrous; leaves oval, ½ to ¾ inch long, on petioles 3 to 4 times as long.—High Sierra Nevada, 7500 to 9500 feet. Seems no more than a slightly reduced state of the common form of the species prevailing at lower altitudes in the Sierra.

Locs.—Hockett's Mdw., *Culbertson* 4441; Farewell Gap, *Jepson* 1035; Wildflower Lake, Kearsarge Pass, *Jepson* 878; Mt. Tallac, *Fox*.

Var. **scapigerum** Jepson n. comb. Like var. deductum but the inflorescence reduced to single heads terminating the slender scape-like stems.—High mountains about the upper Kern River.

Locs.—Cirque Peak, *Hall & Babcock* 5504; near Whitney Meadows, *Purpus* 1559.

Var. **pubiflorum** Benth. Stems 1½ to 3 feet high, often inflated, glabrous, the branches elongated; involucres 1 to 3 in a place; calyx deep yellow, hairy towards the base.—Desert region: Pahute Peak, *Purpus* 5535; Mt. Pinos, *Hall* 6623 (calyx white); Independence, *Hall & Chandler* 7295; Goose Valley, Modoc Co., *Austin & Bruce;* Yreka, *Butler* 213, 1605; Hamburg, Siskiyou Co., *Jepson* 2954.

Var. **pauciflorum** Wats. Stems often inflated, indefinitely dichotomous, the involucres scattered along the slender branches or occasionally in pairs; calyx white.—Southern California: San Jacinto and San Bernardino mountains.

Var. **oblongifolium** Wats. Stems and involucres whitish tomentulose, the stems about twice di- or tri-chotomous, the branches rather strict; leaves broadly oblong, ½ to 2½ inches long, abruptly contracted to slender petioles 1½ to 3 inches long; calyx white or rarely pale yellow, somewhat pubescent on the inner lobes.—Napa Co. to Humboldt Co. and east to Modoc Co., thence south to Nevada Co., here apparently blending with the ordinary Sierran form.

Var. **sulphureum** Jepson n. comb. Like the preceding but the branches of the inflorescence more spreading; calyx pale yellow or white, a little hairy at base.—Eden Valley, Mendocino Co., to Siskiyou Co.

Var. **auriculatum** J. P. Tracy in herb. Stems ½ to 2½ feet high, somewhat caudex-like at base, the caudexes set with leaves or old leaf-bases, ½ to 4 inches high, each giving rise to a glabrous glaucous peduncle bearing a dichotomous panicle; peduncles sometimes strongly fistulous; leaves oblong to elliptic, obtuse, truncatish or subcordate at base, crenulate-undulate margined, densely white-lanate below, soon glabrescent and deep green above, 1 to 2½ inches long; panicle usually large, the heads large, terminal and lateral, less commonly in the forks.—Central Coast Ranges, dry rocky hills.

Locs.—Berkeley and Oakland hills. This form differs from the Sierra Nevada plant at middle altitudes in its stouter stems, larger and denser heads which are often lateral on the branches of the panicle as well as terminal. It is a peculiarity of the flowers that they tend to persist in age, whereas in Sierra Nevada specimens they quickly fall in drying.

Var. **grande** Jepson n. comb. Tall (3 to 5 feet high) with a woody base; leaves ovate-oblong, the margin undulate-revolute, white-lanate below, 1½ to 3 inches long; involucres 3 lines long; calyx nearly or quite glabrous inside. —Santa Barbara Islands.

Refs.—ERIOGONUM NUDUM Dougl.; Benth. Trans. Linn. Soc. 17: 413 (1837), type loc. Multnomah (Willamette Valley), Ore., *Douglas*. *E. longulum* Greene, Pitt. 5: 70 (1902), type loc. Lake Co. region. *E. oblanceolatum* Greene, l. c. 71, type loc. Mt. St. Helena. Var. DEDUCTUM Jepson. *E. deductum* Greene, Pitt. 5: 71 (1902), type loc. high Sierra Nevada. Var. SCAPIGERUM Jepson. *E. scapigerum* Eastw. Proc. Cal. Acad. ser. 3, 2: 286, type loc. Harrison's Pass, Tulare Co., *Eastwood*. Var. PUBIFLORUM Benth. in DC. Prodr. 14: 13 (1856), type collected by Fremont in California, probably in the Mohave Desert. *E. saxicolum* Heller, Muhl. 2: 191 (1906), type loc. Bishop, *Heller* 8298. Var. PAUCIFLORUM Wats. Proc. Am. Acad. 12: 264 (1877). Var. OBLONGIFOLIUM Wats. Proc. Am. Acad. 12: 264 (1877). *E. affine* Benth. in DC. Prodr. 14: 13 (1856), type loc. Umpqua River, Oregon, *Pickering & Brackenridge;* calyx glabrous. *E. harfordii* Small, Bull. Torr. Club, 25: 47 (1898), type loc. Long Valley, Mendocino Co., *Kellogg & Harford,* is very similar to var. oblongifolium. *E. capitatum* Heller, Muhl. 2: 27 (1905), type loc. Nevada City, *Heller* 8099. Var. SULPHUREUM Jepson. *E. sulphureum* Greene, Pitt. 5: 70 (1902), type loc. Yreka, *Greene* 923; very whitish tomentose and the branches of the inflorescence more divergent than usual. Var. AURICULATUM Tracy. *E. auriculatum* Benth. Trans. Linn. Soc. 17: 412 (1837), type from California, *Douglas;* "petiolis basi saepius auriculato-dilatatis" says Bentham, but in DC. Prodr. 14: 13 he says "petiolis longis basi saepius auriculato-dentatis", neither of which phrases apply well to our plants referred to this variety, which should be described as *petiolis sublongis basi subamplexicaulibus.* Var. GRANDE Jepson. *E. grande* Greene, Pitt. 1: 38 (1887), type loc. Santa Cruz Isl. *E. rubescens* Greene, l. c. 39, type loc. San Miguel Isl.; flowers rose-red.

44. **E. elatum** Dougl. Stems rigid and rush-like, rarely naked, 1 to 2½ feet high, sometimes inflated, bearing a trichotomous panicle, glabrous and glaucous; leaves erect, ovate to ovate-lanceolate, 1 to 3 (or 5) inches long, on petioles mostly as long; involucres in terminal clusters of 2 to 4, or solitary in the forks, either sessile or shortly pedunculate, hairy-pubescent, 2¼ lines long, 5-toothed, the teeth scarious-margined; calyx white, 1 to 1½ lines long, its segments obovate, rounded at apex, with broad hairy-pubescent midvein. Mountains, northern California to Washington and Nevada.

Locs.—Mono Lake, *Congdon;* Eagle Lake, Lassen Co., *Baker & Nutting;* Modoc Co., *R. M. Austin;* Independence Creek, Siskiyou Co., *Butler* 202.

Var. **villosum** Jepson n. var. Stems villous-pubescent.—(Caules villoso-pubescentes.)—Dry hills, northern California: Yreka, *Butler* 1606. Ranging east into Modoc Co.

Var. **incurvum** Jepson n. var. Pubescence of preceding; branches or rays of ternately trichotomous panicle curving, fragile at the joints.—(Pubescentia praecedentis; radii paniculae curvati, nodi fragiles.)—Shasta Sprs., *Jepson.*

Ref.—ERIOGONUM ELATUM Dougl.; Benth. Trans. Linn. Soc. 17: 413 (1837), type loc. Columbia River, *Douglas.*

45. **E. indictum** Jepson n. sp. Stems 1 to 2 feet high, several from the base, glabrous, glaucous, the lower internodes inflated like a slender trumpet; leaves ovate or deltoid-ovate, truncatish at base, white-woolly below, whitish-arachnoid above, persistent on both faces, 1½ to 2½ inches long, the petioles as long and with a broad clasping base; involucres externally glabrous, tubular but a little widened upward, 2 lines long, solitary and racemose along the slender branches of the dichotomous panicle; calyx yellowish, glabrous.—(Caules 1-2 pedales, glabri, glauci, internodiis inferioribus inflatis; inflorescentia dichotomo-panicula, ramis tenuibus et involucris solitariis racemosis; involucra subtubulosa, glabra, glauca, lin. 2 longa.)

Dry hills, San Carlos Range. Nearly related to E. nudum.

Locs.—Rancho Cantua, *S. C. Lillis*, type; San Carlos Creek, *Jepson* 2722.

46. **E. kennedyi** Porter. Stems scape-like, wiry, 3 to 8 inches high, arising from a very dense leafy cushion; leaves obovate or oblong, revolute, white-woolly, 1½ to 5 lines long; involucres tomentulose or glabrate, turbinate-campanulate, nerved and rather strongly angled, deeply triangular-toothed, 1½ to 2 lines long, clustered in a terminal head; calyx white or pink, glabrous, 1 to 1½ lines long, segments oblong-obovate; ovary scabrous.

Desert slopes or arid plateaus, north and south of the Mohave Desert.

Locs.—Mt. Pinos, *Hall* 6445; San Bernardino Mts. (where often very much reduced), *Abrams* 2890; foothills west of Bishop, *Heller* 8317.

Refs.—ERIOGONUM KENNEDYI Porter; Wats. Proc. Am. Acad. 12: 263 (1877), Sierra Nevada in Kern Co., *W. L. Kennedy*.

E. purpusi Brandegee, Bot. Gaz. 27: 457 (1899), type loc. Argus Mts., *Purpus* 5484. Leaves obovate, 2 to 3 lines long; peduncles filiform; calyx-segments elliptic, abruptly dilated from the base. The sinuses of the involucre usually split down rather freely in the type. Also collected at Independence by *Hall & Chandler* 7297. It seems to be conspecific with E. kennedyi. *E. gracilipes* Wats. Proc. Am. Acad. 24: 85 (1889), type loc. White Mts., Mono Co., *Shockley*, with glandular-puberulent peduncles seems to be very similar to E. kennedyi also.

47. **E. ochrocephalum** Wats. Stems scape-like, 2 to 6 inches high, erect from a caespitose leafy base; leaves silvery-tomentose, oblanceolate to ovate, ¾ to 1¼ inches long, narrowed to a petiole half to as long; involucres in a capitate cluster, turbinate-bellshaped, bladdery in age, 1½ to 2½ lines long, the 6 to 8 short lobes erect; calyx yellow, glabrous, 1 to 1¼ lines long, the segments elliptic, the inner narrower, all obtuse; filaments obscurely puberulous at base.

Northwestern Nevada and eastern Oregon.

Var. **agnellum** Jepson n. var. Dwarfer form, 2 to 4 inches high, the upper portion of peduncles and heads a little glandular; leaves ovate or narrowly obovate, 2 to 4 lines long, petioled.—(Nanior, pedunculis uncialis 2-4 ad summis capitisve subglandulosis, foliis ovatis vel obovatis angustatis, lin. 2-4 longis, petiolatis.) — Northern Sierra Nevada: Placer Co., *Sonne*, type, to Modoc Co. (Willow Creek Valley, *R. M. Austin*).

Ref.—ERIOGONUM OCHROCEPHALUM Wats. Bot. Cal. 2: 480 (1880), type loc. n. w. Nev., *Lemmon*.

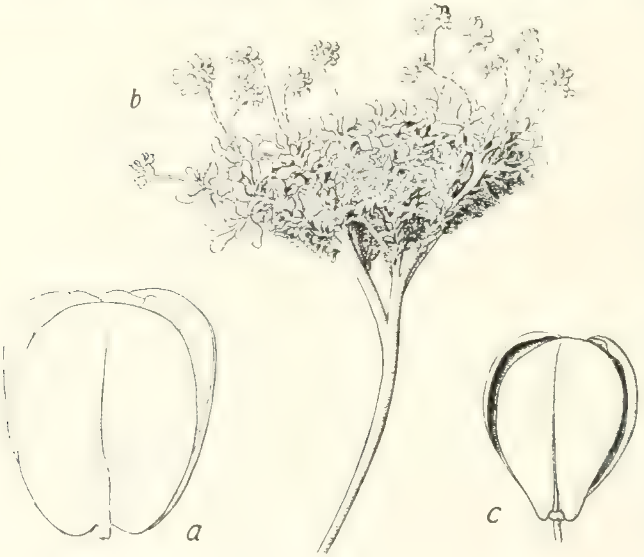

Fig. 80. *a*, ERIOGONUM OVALIFOLIUM Nutt.; flower, x 10. *b*, var. NIVALE Jones; habit, x 1; *c*, flower, x 10.

48. **E. ovalifolium** Nutt. (Fig. 80a.) Subalpine dwarf, the scape-like stems slender, tomentulose, ½ to 3 inches high, rising from a dense leafy cushion; leaves round-ovate to obovate, 1 to 4 lines long, contracted to a usually short petiole; involucres turbinate, woolly, several crowded together in a very close head with 3 or 4 short bracts; calyx white,

with green midribs, often fading pinkish, glabrous, 1 to 1½ lines long; outer calyx segments elliptical, subcordate at base, their margins quite free and distinct to base, the inner broadly spatulate; filaments hairy at very base.

Granite peaks and ridges, Sierra Nevada, 9000 to 12,000 feet. North to British Columbia and east to the Rocky Mts.

Locs.—Kearsarge Pass, *Jepson* 899; Mono Pass, *Jepson* 4465; Lambert Dome, *Jepson* 3248; Lake Eleanor, *H. W. Turner;* Castle Peak, Nevada Co., *Heller* 7081; Snow Mt., Lake Co., *K. Brandegee.*

Var. **vineum** Jepson n. comb. Involucres vase-shaped, constricted near the top; calyx wine-red, 2½ to 3 lines long, its segments unequal.—High montane, California to Washington. Little known to us.

Var. **nivale** Jones. (Fig. 80b, c.) Head small and compact, appearing like a single involucre; flowers red; outer calyx-segments obovate; filaments hairy or glabrous.—Southern Sierra Nevada.

Locs.—Tower Peak, *Jepson* 4548; Mt. Dana, *Chesnut & Drew;* Mt. Whitney, *Jepson* 1087, *Hall & Babcock* 5530; Army Pass, *Jepson* 5064; Olancha Peak, *Purpus.*

Refs.—ERIOGONUM OVALIFOLIUM Nutt. Jour. Acad. Phila. 7: 50, pl. 8, f. 1 (1834), type loc. headwaters of the Missouri, *Wyeth.* Var. VINEUM Jepson. *E. vineum* Small, Bull. Torr. Club, 25: 45 (1898), type locs. Rose Mine, San Bernardino Mts., *Parish* 3170, and Powder River Mts., Ore., *Cusick.* Var. NIVALE Jones, Contrib. 11: 8 (1903). *E. nivale* Canby, Contrib. U. S. Nat. Herb. 4: 187 (1893). In material of E. nivale from type locality (Siberian Pass, *Hall & Babcock* 5481) the involucres appear, as said in original description, to be solitary, but examination reveals 3 or 4 involucres so closely crowded in a deeply 3 or 4-parted primary involucre or whorl of bracts as to appear like a single involucre. This form is doubtfully of even varietal value.

49. **E. proliferum** T. & G. Stems erect, naked, scape-like, 4 to 7 inches high, bearing an umbellate inflorescence and arising from a compactly branched caudex with very short leafy branches; herbage tomentulose, the leaves densely white-woolly; leaves ovate, mostly obtuse, 4 to 12 lines long, on petioles as long or longer; umbels with 3 rays from beneath the sessile central involucre; rays ½ to 2 inches long, somewhat unequal, bearing a cluster of 2 or 3 involucres, or one or more of the rays again shortly 3-radiate; involucre 5-toothed, the teeth large, almost hooded; calyx white, 2 to 2½ lines broad, the outer segments roundish quadrate or elliptic (nearly as broad at base and apex as at middle), attached by the lower ⅓ of the midnerve, the sides free and overlapping; inner segments obovate, narrowed to a claw-like base.

Northern Sierra Nevada to Siskiyou Co.; north to British Columbia and east to the Rocky Mts.

Locs.—Sierra Valley, *Lemmon;* Yreka, *Butler* 970, 1417; Little Shasta Valley, *Hall & Babcock* 4099; Scott Valley, *Jepson* 2196; Marble Mt. region, *Butler* 211.

Refs.—ERIOGONUM PROLIFERUM T. & G. Proc. Am. Acad. 8: 164 (1870), type loc. Columbia River region. *E. greenei* Gray, Proc. Am. Acad. 12: 83 (1876), type loc. Yreka, *Greene. E. dichotomum* Wats. Bot. Cal. 2: 26 (1880), not Dougl. *E. ovalifolium* var. *proliferum* Wats. Proc. Am. Acad. 12: 263 (1877).

E. ANSERINUM Greene, Pitt. 4: 320 (1901), type loc. Goose Lake, Modoc Co., *R. M. Austin.* Inflorescence narrow and fastigiate; calyx greenish yellow (ex char.).

III.—SUBGENUS **Eueriogonum.**

Involucres turbinate, 4 to 8-toothed or -lobed, either solitary or borne in umbels, the umbels sometimes congested in heads; bracts foliaceous; calyx stipe-like at base, often accrescent, filaments mostly hairy or pubescent at base; flowering stems (peduncles) scape like; perennials; mountains from middle altitudes to alpine summits.

50. **E. caespitosum** Nutt. Dwarf, matted, the scape-like peduncles slender, naked, 2 to 4 inches high, bearing a single involucre; leaves white-tomentose, oval to oblong-spatulate, 2 to 3 lines long, the petioles ⅓ to as long; involucral lobes linear, as long or longer than the turbinate tube; calyx yellow or fading reddish, 1 to 1½ lines long, in age nearly twice as long, hairy on the mostly stipe-like base; filaments pilose; ovary glabrous.

Mountain slopes and dry plateaus east of the Sierra Nevada. Nevada, Oregon, east to the Rocky Mts.

Locs.—Lake City, Modoc Co., *Bruce;* White Mts., *Purpus* 5798.

Ref. ERIOGONUM CAESPITOSUM Nutt. Jour. Acad. Phila. 7: 50, pl. 8, f. 2 (1834), type loc. headwaters of the Columbia, *Nuttall.*

51. **E. douglasii** Benth. Matted white-woolly dwarf similar to the preceding, the scape-like peduncles with a whorl of 5 or 6 oblanceolate bracts at the middle; involucral lobes linear, longer than the tube, reflexed; calyx yellow, hairy at base and along the midrib of the segments, stipe-like at base, 2 to 3 lines long, its segments obovate, obtuse, the inner exceeding the outer in age; lower half of filaments pilose; ovary hairy towards apex.

Northern Sierra Nevada. Nevada to Washington.

Locs.—Donner, *Kellogg* in 1870; Sierra Valley, *Lemmon;* Susanville, *Brandegee.*

Refs.—ERIOGONUM DOUGLASII Benth. in DC. Prodr. 14: 9 (1856), type loc. Blue Mts., Ore., *Gairdner, Douglas. E. caespitosum* var. *douglasii* Jones, Contrib. 11: 7 (1903), the reduction perhaps well taken.

52. **E. sphaerocephalum** Dougl. Peduncles 3 to 6 inches high, bearing a solitary involucre and with a whorl of leafy bracts at their middle, or the whorl subtending a 2 to 4-rayed umbel, the rays also bearing a central whorl of bracts; base much-branched, with many short woody leafy branchlets; leaves oblong to broadly oblanceolate, acute, narrowed to a short petiole, 5 to 10 lines long, white-woolly below, soft pubescent above, the margins often revolute; involucre almost bowl-shaped, 3 to 4 lines long, its (7 or 8) oblong lobes as long or longer than the tube; flowers numerous in an involucre, forming a globose cluster; calyx whitish, very villous inside and out, especially towards the base, stipe-like at base, 4 lines long, the segments obovate or elliptic, obtuse; filaments hairy on lower half; ovary densely villous except at base.

Lassen Co. to Shasta Co. and north to Washington. May-June.

Locs.—Susanville, *Brandegee;* Egg Lake, *Baker & Nutting;* Willow Creek Valley, Modoc Co., *Austin;* Pit River Valley, *Hall & Babcock* 4253; Yreka, *Butler* 721, 1371, 1428.

Refs.—ERIOGONUM SPHAEROCEPHALUM Dougl.; Benth. Trans. Linn. Soc. 17: 407 (1837), type loc. Columbia River, *Douglas.*

53. **E. tripodum** Greene. Habit similar to E. sphaerocephalum but more slender and taller (10 to 14 inches high); umbel 3-rayed, the rays 3 to 5 inches long, bearing a whorl of bracts at the middle or sometimes 2-forked and again bracteate; calyx yellow, densely hairy, 2 to 3 lines long, the stipe-like base very short; filaments hairy below; ovary very strongly angled, hairy at apex.

Indian Valley, Lake Co., *Cleveland;* Benton Mills Road, Mariposa Co., *Congdon.*

Ref.—ERIOGONUM TRIPODUM Greene, Pitt. 1: 39 (1887), type loc. Hough's Sprs., Lake Co., *K. Curran. E. sphaerocephalum* var. *brevifolium* Stokes; Jones, Contrib. 11: 6 (1903).

54. **E. siskiyouensis** Small. Like E. umbellatum but the involucre solitary on an erect peduncle 4 to 10 inches high, with a whorl of bracts at middle (that is, the umbel reduced to one ray which is as long or longer than the peduncle); bracts foliaceous, ovate, petioled, 2 to 6 lines long, the basal leaves of the same shape but usually larger.

High montane: Scott Mts., Siskiyou Co.; Calaveras Big Trees, *Brandegee;* Lake Merced, *Jepson* 3183. Hardly more than a variant of E. umbellatum and yet unlike the dwarf monocephalous states of that species.

Ref.—ERIOGONUM SISKIYOUENSIS Small, Bull. Torr. Club, 25: 44 (1898), type loc. Scott Mts., *Greene.*

55. **E. umbellatum** Torr. SULPHUR-FLOWER. (Fig. 81.) Peduncles erect or ascending from a branching woody base, naked, 3 to 5 inches high, tomentulose or glabrate; leaves ovate, glabrate above, white-woolly beneath, 3 to

12 lines long, on petioles ¼ to ½ as long; umbels simple, subtended by a whorl of linear to obovate bracts, its rays 3 to 9 (rarely reduced to 1), 5 lines to 1¼ inches (or 3) long, these and the bracts soft-pubescent; involucre 8-lobed, the lobes reflexed, nearly as long as the turbinate tube, the tube and throat crowded with the floccose-woolly bractlets; flowers sulphur-yellow; calyx glabrous, gradually narrowed into the long stipe-like base, 2 to 3, or in age 3 to 4 lines long; filaments pilose on lower half.

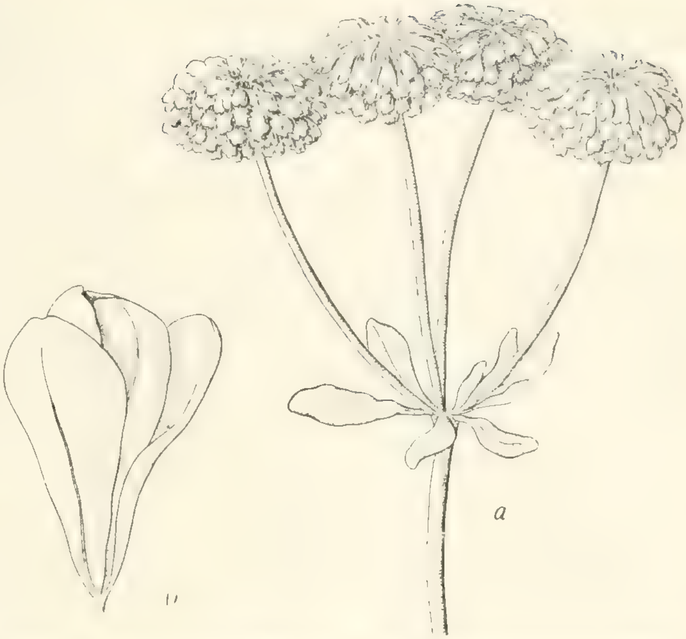

Fig. 81. Eriogonum umbellatum Torr. *a*, umbel, past anthesis, x 1; *b*, flower, x 8.

Higher Sierra Nevada and Coast Ranges, 4000 to 9000 feet; north to Washington and east to the Rocky Mts.

Locs.—Shasta River, *Butler* 968; Humbug Mt., *Butler* 215; near Mt. Shasta, *Jepson;* King Creek, Lassen Co., *Jepson* 4115; Portola, *K. Brandegee;* Bear Valley, Nevada Co., *Jepson;* Lake Merced, Yosemite Park, *Jepson* 3183; Glacier Pt., *Jepson* 5643; near Mt. Whitney, *Jepson* 936; Farewell Gap, *Jepson* 997; Trinity Summit, *Jepson* 2119; South Yollo Bolly, *Jepson.*

Var. **stellatum** Jones. Rays simple and bearing a whorl of bracts at their middle or usually forked and the secondary rays similarly bracteate.—San Bernardino Mts.; Sierra Nevada; Siskiyou Co.; north to Washington.

Var. **bahiaeforme** Jepson n. comb. Inflorescence freely and irregularly branched.—Tehachapi region.

Var. **monocephalum** T. & G. Dwarf mountain form with the umbel reduced to a single ray, that is, the peduncle naked or bracteate and bearing a solitary involucre.—Range of the species but far less common. Snow Mt., *K. Brandegee;* South Yollo Bolly, *Jepson.*

Refs.—Eriogonum umbellatum Torr. Ann. N. Y. Lyc. Nat. Hist. 2: 241 (1828), type loc. Rocky Mts.; Benth. Trans. Linn. Soc. 17: 410, t. 18, fig. 2 (1837); Sitgreaves Exped. pl. 12 (1853). *E. speciosum* Drew, Bull. Torr. Club, 16: 152 (1889), type loc. S. Fork Trinity River, Hy-am-pum Valley, *Chesnut & Drew.* *E. dumosum* Greene, Pitt. 3: 199 (1897), type loc. American Valley, Plumas Co., *R. M. Austin,* said to be a shrub 5 or 6 feet high. *E. trichotomum* Small, Bull. Torr. Club, 25: 43 (1898), type loc. Mt. Hamilton, *Greene.* *E. reclinatum* Greene, Pitt. 5: 67 (1902), Sierra Nevada and adjacent Nev. (the peduncles ascending). *E. modocense* Greene, l. c. 68, type loc. Davis Creek, Modoc Co. *E. smallianum* Heller, Bull. S. Cal. Acad. 2: 68 (1903), type loc. Mt. Sanhedrin, *Heller* 5996. Var. stellatum Jones, Contrib. 11: 5 (1903). *E. stellatum* Benth. Trans. Linn. Soc. 17: 409 (1837), type loc. interior of N. W. America, *Douglas.* *E. croceum* Small, Bull. Torr. Club. 25: 43 (1898), based on Idaho and Oregon spms. Var. bahiaeforme Jepson. *E. stellatum* var. *bahiaeforme* Wats. Bot. Cal. 2: 20 (1880). *E. ovatum* Greene, Pitt. 5: 69 (1902), type loc. Silver Lake, Lassen Co., *Baker & Nutting.* Var. monocephalum T. & G. Proc. Am. Acad. 8: 160 (1870), type loc. western U. S.

56. **E. torreyanum** Gray. Habit of E. umbellatum but stems and leaves glabrous; outer rays of the umbel with a whorl of bracts midway; leaves obovate, thickish, about 1 inch long, narrowed below to a petiole as long; involucral lobes sparingly pubescent; calyx yellow, 4 to 5 lines long; filaments hairy below.

Northern Sierra Nevada, 5000 to 7000 feet. This seems to be only a glabrous form of E. umbellatum.

Locs.—Squaw Creek, Placer Co., *Sonne;* Donner, *Kellogg;* Webber Lake, *Lemmon.*

Refs.—Eriogonum torreyanum Gray; T. & G. Proc. Am. Acad. 8: 158 (1870), type loc. Donner's Pass, *Torrey* 443. *E. umbellatum* var. *torreyanum* Jones, Contrib. 11: 5 (1903).

57. **E. compositum** Dougl. Scape-like stems stout, 6 to 16 inches high from a simple short caudex, glabrate; leaves oblong-ovate or deltoid-ovate, cordate at base, 1½ to 2 inches long, with a close white felt beneath, green above or woolly-flocculent; petioles long, mostly 1 to 2½ times length of blade; bracts linear or oblanceolate; umbel 6 to 10-rayed, the rays sometimes with a blackish band at middle, ½ to 2 inches long, each bearing a capitate cluster of 1 to 5 involucres or a several-rayed umbellet; involucre broadly turbinate, woolly, 8-toothed, the teeth short, acute; calyx cream-color or yellow, glabrous, contracted to a stipe-like base, 2 to 4 lines long; segments elliptic, the inner becoming ⅓ longer in age; filaments short hairy at base.

North Coast Ranges. Far northward to Washington.

Locs.—Napa Range (near Calistoga) and Snow Mt. (Lake Co.), *K. Brandegee;* Long Valley, Mendocino Co., *Bolander* 6567; w. Siskiyou, *Jepson* 2095; Castle Peak, n. e. Mendocino Co., *Jepson;* Siskiyou Co., *Butler* 201 (Independence Creek) and 720 (Klamath River). June-Aug.

Ref.—Eriogonum compositum Dougl.; Benth. Bot. Reg. t. 1774 (1836), type loc. Columbia River, *Douglas.*

58. **E. lobbii** T. & G. Peduncles lying along the ground, 2 to 7 inches long, borne on a densely leafy stout caudex; caudex crowded below with old leaf-bases and crowned with a tuft of silvery white leaves; herbage densely white-woolly; leaves roundish, oval or ovate, ½ to ¾ or 1¼ inches long, narrowed to rather broad petioles ½ to as long; umbels simple, bracteate, ascending from the tips of the peduncles; rays 3 to 6, ½ to 1½ inches long (or reduced and then the umbels capitate), usually with a whorl of bracts at middle; involucres broadly campanulate, 3 to 5 lines long; calyx white, fading pinkish, narrowed at base but not stipe-like, 3 to 4 lines long; filaments pilose on lower half.

Gravelly drifts and glaciated granite slopes and ridges, Sierra Nevada (Yosemite Park to Nevada Co.) and inner North Coast Range, 7000 to 9500 feet. Western Nevada near Lake Tahoe.

Locs.—Mt. Conness, *Hutchings;* Lambert Dome, *Jepson* 3249; Rancheria Mt., *Jepson* 4589; Macomb Ridge, Yosemite Park, *Jepson* 8572; Bierstadt Peak, *Davy* 3226; Donner Pass, *Heller* 7011; high peaks near Sierra Valley, *Lemmon;* Placer Co., *Carpenter;* South Yollo Bolly, *Jepson;* mts. north of Clear Lake, *Mackie.*

Ref.—Eriogonum lobbii T. & G. Proc. Am. Acad. 8: 162 (1870), based on *Lobb* 190 (probably northern Sierra Nevada), *Torrey* (mts. near Donner Pass), and *Stretch* (near Virginia City, Nev.).

59. **E. pyrolaefolium** Hook. Peduncles scape-like, glabrous, 2 to 3½ inches high, arising from a densely leafy caudex; leaves roundish or oval, thick, glabrous, 4 to 12 lines long, abruptly petioled, the petioles villous; umbels small, bearing 1 to 3 involucres on short (1 or 2 lines long) rays or quite capitate; bracts 2, linear or spatulate, elongated; calyx red, not attenuate at base, 1½ to 2 lines long, somewhat glandular inside, hairy at base outside and on midribs half-way up segments; filaments glabrous; upper part of ovary densely hairy.

High northern peaks: Mt. Lassen; Mt. Shasta. North to Mt. Rainier.

Ref.—Eriogonum pyrolaefolium Hook. Jour. Bot. & Kew Misc. 5: 395, pl. 10 (1853), type loc. Mt. Shasta, *Jeffrey.*

60. **E. latens** Jepson n. sp. Peduncles naked, 8 to 12 inches high from the short leafy branches of a woody caudex; leaves roundish, or somewhat deltoid-ovate, acutish, short pilose, 7 to 12 lines long, abruptly or cuneately narrowed at base to a margined petiole half to as long as the blade; involucres congested in a terminal head, membranous, campanulate, 3 to 4 lines long, with short broad sparsely hairy lobes; calyx white, its base appressed hairy, the inner segments narrower than the outer; lower third of filaments pubescent.—(Caulis brevissimus caespitosus ramosus, pedunculo nudo 8-12 pollicario; folia lin. 7-12 longa approximata orbiculata vel delto-ovata acutiuscula utrinque breve pilosa ad basin in petiolum marginatum abrupte cuneateve angustatum; involucra ad apicem pedunculi capitata membranacea campanulata lin. 3-4 longa, lobis brevibus latisque; calyx albus extus basi hirsuto-appressus, segmentis interioribus quam exterioribus angustioribus.)

Desert slopes in Inyo Co.: Timosea Peak, *Jepson* 5082, 6500 ft. alt.

61. **E. ursinum** Wats. Peduncles scape-like from a branching woody leafy crown or mat, 4 to 12 inches high, these and the umbels villous-tomentulose; leaves ovate, mostly acute, cordate at base, varying to cuneate, white-tomentose beneath, glabrate and greener above, 4 to 8 lines long, the petiole half to as long; umbel compound, sometimes simple, 3 to 10-rayed or reduced to a head-like cluster; bracts obovate to subfiliform, subtending the umbel and secondary umbels, usually also with a whorl at or near the middle of the rays or secondary rays; involucres campanulate-funnelform, large (3 to 3½ lines high), thin, hairy-pubescent outside, shortly and sharply toothed; calyx yellow or white, glabrous, abruptly campanulate above the stipe-like base, 2 to 3 lines long; filaments copiously woolly, the wool filling the base of the calyx.

High montane, northern Sierra Nevada and North Coast Ranges, 5000 to 8000 feet.

Locs.—Near Summit Station, *Sonne;* Sierra Co., *Eva Kennedy;* Cisco, *Harriet Walker;* Indian and American valleys, *Lemmon;* Mt. Lassen, *Jepson* 4103; Morgan, *Hall & Babcock* 4405; Snow Mt., Lake Co., *Brandegee.*

Ref.—ERIOGONUM URSINUM Wats. Proc. Am. Acad. 10: 347 (1875), type loc. Plumas Co. (Long and Bear valleys), *Mrs. M. E. P. Ames, Lemmon.*

62. **E. incanum** T. & G. Peduncles stout, tomentulose, 1 to 3½ inches high, arising from a matted densely leafy crown; leaves white-tomentose, oblong to ovate or obovate, the edges often disposed to be revolute, 3 to 6 lines long, mostly short-petioled; umbels with 4 or 5 rays 2 to 6 lines long or reduced to a small dense head; bracts few, linear; calyx yellow, often red, glabrous, 1 to 2 lines long, narrowed to a short stipe-like base; filaments sparingly hairy at base.

Gravelly slopes and peaks, high Sierra Nevada, 7000 to 12,000 feet.

Locs.—Farewell Gap, *Purpus* 1572; Mt. Whitney, *Jepson* 1076; Bullfrog Lake, *Jepson* 844; Mt. Goddard, *Hall & Chandler* 696; El Capitan, *Jepson* 4364, 4365; Clouds Rest, *Drew;* Mt. Lyell, *Hall & Babcock* 3594, *Jepson* 3327, 3328; Macomb Ridge, *Jepson* 4563, 4564; Tower Peak, *Jepson* 4547; Mt. Ralston, *Hall & Chandler* 4669.

Refs.—ERIOGONUM INCANUM T. & G. Proc. Am. Acad. 8: 161 (1870), based on Sierra Nevada specimens, *Brewer* (upper Tuolumne River), *Torrey, Bolander. E. rosulatum* Small, Bull. Torr. Club, 25: 46 (1898), type loc. Mineral King, *Coville & Funston* 1549, "filaments glabrous."

63. **E. marifolium** T. & G. Peduncles scape-like, slender, 3 to 12 inches high, arising from a loosely branched leafy base; leaves oval or ovate, white-woolly or commonly glabrate above, 3 to 8 lines long, the petioles mostly as long or longer; umbels with 3 to 6 rays ½ to 2½ inches long, the central involucre sessile, or the umbel sometimes reduced to a small head; flowers often more or less dioecious; yellowish (reddish in age), glabrous, 1 to 1½ lines long.

Higher Sierra Nevada. Perhaps only a variety of the preceding; differs only in its looser growth and larger umbels.

Locs. Tilden Cañon, Yosemite Park, *Jepson* 4543; Silver Lake, *Hansen* 1261; Summit, Nevada Co., *Jepson;* Donner Pass, *Heller* 7014; Medicine Lake Mts., Siskiyou Co., *M. S. Baker;* Mt. Shasta, *Jepson.*

Refs.—ERIOGONUM MARIFOLIUM T. & G. Proc. Am. Acad. 8: 161 (1870), based on *Lobb* 192 (probably northern Sierra Nevada), *Brewer* (Mt. Shasta), and *Torrey* (Donner Pass). *E. polypodum* Small, Bull. Torr. Club, 25: 46 (1898), type loc. Long Meadow, Tulare Co., *Palmer* 204, filaments glabrous; Merriam, N. Am. Fauna, 16: 143 (1899).

64. **E. kelloggii** Gray. Peduncles rising from a loose mat, scape-like, slender, 2 to 4 inches high, naked save for whorl of 3 leaf-like bracts at the middle; mat consisting of branching stolon-like woody stems with the leaves in rosettes on the ends of short branchlets; herbage tomentulose throughout or the leaves glabrate above; leaves oblanceolate or narrowly obovate, narrowed to a short petiole, 2 to 5 lines long; involucre solitary, turbinate, 2 to 2½ lines long, with erect teeth; calyx whitish or pinkish, glabrous, stipe-like at base, 3 to 4½ lines long, its segments obovate, rounded at apex; filaments pilose below middle.

Red Mt., Mendocino Co., *Eastwood*, not otherwise known. Remarkably similar in all details of habit to the monocephalous forms of E. umbellatum.

Refs.—ERIOGONUM KELLOGGII Gray, Proc. Am. Acad. 8: 293 (1870), type loc. Red Mt., *Kellogg. E. caespitosum* var. *kelloggii* Jones, Contrib. 11: 7 (1903).

65. **E. alpinum** Engelm. White-lanate dwarf, 1½ inches high, the scape-like stems with a whorl of bracts at the middle and ending in a single involucre; leaves roundish, 5 to 7 lines broad; involucre turbinate, 3 lines long, with minute teeth; calyx yellow, glabrous, 1½ to 2 lines long, the stipe-like base short, the segments obovate, obtuse; filaments slightly pubescent at base.

Mt. Eddy, Siskiyou Co., 8700 feet, *Copeland.*

Refs.—ERIOGONUM ALPINUM Engelm. Bot. Gaz. 7: 6 (1882), type loc. Scott Mts., *Geo. Engelmann. E. copelandi* Greene in hb. E. alpinum and E. copelandi are "in my opinion undoubtedly conspecific. The only difference is that the Engelmann specimen has slightly larger leaves but the inflorescence characters are identical."—J. M. Greenman, Mo. Bot. Gard. in litt.

CHENOPODIACEAE. SALTBUSH FAMILY.

Herbs or shrubs, mostly salt-loving, very often succulent or scurfy, with alternate or rarely opposite leaves, or leafless. Flowers small (1 or 2 lines long), perfect or unisexual with an herbaceous calyx of 5 or fewer sepals, or in the pistillate flower the calyx sometimes absent. Stamens as many as the sepals and opposite them, or fewer, distinct or slightly united at base. Ovary superior, 1-celled, containing a single ovule, becoming in fruit an achene or utricle. Styles or stigmas 2 or 3. Embryo curved; endosperm copious or sometimes wanting. Nitrophila has a scarious calyx and stamens not distinct.—About 75 genera and 550 species, mostly of alkaline deserts or steppes, and occurring all over the earth.

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Embryo annular or curved, embracing or surrounding the central endosperm, or folded and the endosperm lacking.
  Stems with foliaceous leaves.
    Leaves opposite, united at base.................................1. NITROPHILA.

Leaves alternate, sometimes the lowest opposite, but never united at base.
Calyx not horizontally winged, leaves plane (except no. 9).
Flowers perfect, all of one kind.
Calyx 3 to 5-parted or -toothed.
Stamen 1; flowers axillary and solitary.........2. APHANISMA.
Stamens 5 (or 4); flowers in clusters.
Calyx with a fleshy disk at base, the ovary partly sunk in it...
3. BETA.
Calyx without disk.
Calyx 5 (or 4)-parted, herbaceous or fleshy in fruit.....
4. CHENOPODIUM.
Calyx saccate, 3 to 5-toothed, dry in fruit...5. ROUBIEVA.
Calyx of 1 sepal; stamen 1..........................6. MONOLEPIS.
Flowers unisexual, of 2 kinds, the staminate with calyx, the pistillate without calyx and enclosed by 2 appressed bracts.
Fruits not hairy; leaves not revolute.
Bracts distinct or more or less united, the margins never wholly united, at least partly free, the sides smooth or muricate...
7. ATRIPLEX.
Bracts wholly united into an orbicular strongly flattened sac with a pin-hole orifice at apex....................8. GRAYIA.
Fruits densely white-hairy; leaves linear, revolute........9. EUROTIA.
Calyx in fruit surrounded by a 5-lobed wing.....................10. KOCHIA.
Stems with the leaves reduced to mere scales; flowers perfect; stems fleshy, jointed.
Shrubs; scales alternate..................................11. SPIROSTACHYS.
Herbs; scales opposite.......................................12. SALICORNIA.
Embryo spirally coiled, the endosperm lateral or none.
Leaves more or less fleshy, soft.
Flowers unisexual, the staminate in a catkin-like spike, the pistillate axillary......
13. SARCOBATUS.
Flowers perfect and pistillate, in axillary clusters....................14. SUAEDA.
Leaves dry, rigid or spiny; flowers perfect...........................15. SALSOLA.

1. NITROPHILA Wats.

A low perennial glabrous herb with fleshy opposite amplexicaul leaves and axillary perfect flowers. Sepals 5 (rarely 6 or 7), chartaceous, imbricated, concave and carinate. Stamens 5, united at base into a narrow yellowish disk. Style longer than the subglobose ovary; stigmas 2. Achene beaked by the persistent style, included within the connivent sepals.—One species. (Greek nitron, carbonate of soda, and philos, fond of, these plants loving alkaline soils.)

1. **N. occidentalis** Wats. Stems decumbent, oppositely branching, 4 to 14 inches long, from a deep-seated thick taproot; leaves linear, sessile, ½ to 1 inch long, the floral mostly 3 to 6 lines long, triangular in cross-section, mucronate; flowers solitary in the axils and bibracteate, or often 2 or 3 with the central one frequently bractless and the lateral shortly pedicelled; sepals pinkish or whitish.

Moist alkaline soils, often on the black alkali: Sacramento Valley south through the San Joaquin Valley to Southern and Lower California; desert side of the Sierra Nevada. Nevada; Oregon.

Locs.—Shasta Valley, *Butler* 1849; Solano Co., San Joaquin Co., *Jepson;* Goshen, *K. Brandegee, Jepson* 2652; Antelope Valley, *Davy* 2249; San Bernardino, *Parish;* Studebaker, Los Angeles Co., *Braunton* 339; Owens Lake, *Jepson* 5097; Lassen Co., *Davy* 3326.

Refs.—NITROPHILA OCCIDENTALIS Wats. Bot. King, 297 (1871), the type spms. from the Pacific Coast. *Banalia occidentalis* Moq. DC. Prodr. 13^2: 279 (1849), type from Oregon, *Nuttall.*

2. APHANISMA Nutt.

Annual with alternate sessile entire leaves. Flowers minute, perfect, without bracts, axillary, solitary. Calyx 3 or 4-cleft, without appendages. Stamen 1. Ovary depressed, the short style 2 or 3-cleft. Achene depressed-globose, indurated, somewhat 5-angled, subtended at base by the closely appressed dry calyx. Embryo annular, surrounding the copious endosperm.—One species. (Greek aphanes, inconspicuous.)

1. **A. blitoides** Nutt. Branched at the base with slender ascending stems, ½ to 2 feet high; leaves ovate, acuminate, cordate or truncate at the sessile base, ½ to 2 inches long, or the lowest lanceolate and long-petioled; achene ½ line broad.

Del Mar; San Diego; Carrizo Creek. Santa Barbara Island.

Refs.—APHANISMA BLITOIDES Nutt.; Moq. in DC. Prodr. 13^2: 54 (1849), type loc. San Diego, *Nuttall*.

3. BETA L.

Robust glabrous biennial herbs with large fleshy roots. Leaves alternate, large, long-petioled, the floral reduced and subsessile. Flowers perfect, greenish white, in sessile axillary clusters; clusters 2 or 3-flowered, disposed in panicled spikes, the flowers cohering in fruit by the enlarged bases of the calyx. Calyx 5-parted, its lobes costate dorsally, in fruit indurated and closing over the achene. Stamens 5, perigynous; filaments frequently connate at base. Ovary sunk in the succulent base of the calyx; styles 2 or 3, short, stigmatose on the inside. Achene adnate to the calyx-base. Embryo annular.—About 12 Old World species. (Perhaps Celtic bett, red, on account of the color of the root.)

1. **B. vulgaris** L. BEET. Stems stout, 2 to 6 feet high, paniculately branched above; root conical; lower leaves 4 to 10 inches long, oblong or ovate, undulate, the upper smaller, ovate-lanceolate.

Naturalized in marshes from gardens: Petaluma; Alvarado; Monterey; San Bernardino. June.

Refs.—BETA VULGARIS L. Sp. Pl. 222 (1753), type European; Jepson, Fl. W. Mid. Cal. 175 (1901).

4. CHENOPODIUM L. GOOSEFOOT. PIGWEED.

Annual or perennial herbs, frequently white-mealy or glandular, with alternate petioled leaves. Flowers perfect, greenish, bractless and sessile, clustered, the clusters commonly in simple or panicled spikes. Calyx 5 (or 3 to 4) -parted, persistent and usually enclosing the seed-like achene, rarely reduced to a single sepal. Stamens 5 or fewer. Ovary depressed; styles 2, rarely 3 or 4, slender. Achene with membranous pericarp closely investing the seed. Embryo annular, sometimes incompletely so.—About 60 species, temperate zones. (Greek chen, goose, and pous, foot, on account of the shape of the leaves.)

- Fruiting calyx dry.
  - Annual; calyx deeply parted into lobes or segments.
    - Finely mealy, at least not pubescent or glandular.
      - Achene with pericarp closely persistent on seed.
        - Erect, herbage light green........................1. *C. album.*
        - Diffuse, herbage dark green........................2. *C. murale.*
      - Achene with pericarp separating readily from seed...........3. *C. fremontii.*
    - Glandular-pubescent and aromatic, but not mealy.
      - Flower-clusters spicate or paniculate.
        - Leaves slender-petioled; achene imperfectly enclosed by calyx; spikes cymose-diverging, leafless........................4. *C. botrys.*
        - Leaves slightly petioled; achene perfectly enclosed by calyx.
          - Spikes dense, leafy........................5. *C. ambrosioides.*
          - Spikes more elongated, leafless................6. *C. anthelminticum.*
      - Flower-clusters all axillary........................7. *C. carinatum.*
  - Perennial; calyx merely toothed or cleft, more distinctly synsepalous; spike terminal, leafy only below; achene exserted........................8. *C. californicum.*
- Fruiting calyx fleshy, often reddish; annual.
  - Calyx deciduous........................9. *C. rubrum.*
  - Calyx persistent, the clusters red and berry-like........................10. *C. capitatum.*

1. **C. album** L. PIGWEED. WHITE GOOSEFOOT. Erect, 2 to 4 feet high, usually paniculately branched; herbage more or less light green or white-

mealy; leaves rhombic-ovate, sinuate-dentate below or about the middle, the uppermost varying to lanceolate and subentire, 1 to 2 inches long, whiter beneath than above; flowers densely clustered in close spikes, the panicle strict and close or somewhat spreading; calyx about ¾ line wide in fruit, the lobes strongly carinate.

Common European weed in half-cultivated lands. July-Oct. Also called Lambs Quarters; the herbage makes excellent boiled greens when taken young. Var. VIRIDE Moq. Leaves bright green on both sides or only slightly mealy beneath; inflorescence less dense.—Widely distributed but not as common as the species.

Refs.—CHENOPODIUM ALBUM L. Sp. Pl. 219 (1753), type European; Jepson, Fl. W. Mid. Cal. 175 (1901). Var. VIRIDE Moq. in DC. Prodr. 13^2: 71 (1849).

C. VULVARIA L. Sp. Pl. 220 (1753). Diffuse, mealy, very ill-scented; leaves deltoid-ovate, entire; sepals not carinate.—European weed; Sacramento acc. Greene, Fl. Fr. 165.

C. GLAUCUM L. Sp. Pl. 220 (1753). Prostrate or spreading, glaucous-mealy; leaves oblong, rather coarsely 3 or 4-toothed on each side, 5 to 10 lines long, white below, green above; flower-clusters in leafless axillary spikes.—European weed, widely naturalized in U. S.; Suisun Marshes acc. Greene, Fl. Fr. 167.

2. **C. murale** L. NETTLE-LEAF GOOSEFOOT. Rather stout and succulent, the loose branches decumbent and ascending, 8 to 15 inches long; herbage dark green, the growing parts very finely mealy; leaves rhombic-ovate, irregularly and sharply toothed above the base, 1 to 1¾ inches long; flowers in rather dense axillary or terminal spicate panicles; panicles leafless, or nearly so, often very small; fruiting calyx closed; achene acutely margined.

Naturalized from Europe; a common weed in old yards and waste places, flowering through the winter.

Refs.—CHENOPODIUM MURALE L. Sp. Pl. 219 (1753), type European.

3. **C. fremontii** Wats. Erect, slender, branching, ½ to 2 feet high; white-mealy to light green; leaves triangular-hastate, mostly entire, truncate or broadly cuneate at base, 5 to 7 lines long, on slender petioles half to as long, the lowest 1 to 2 inches long, the upper narrower and reduced; flower-clusters in slender spikes of the open panicle; sepals strongly carinate, nearly enclosing the achene.

Panamint Mts. acc. Coville; east to the Rocky Mts. and north to Oregon.

Refs.—CHENOPODIUM FREMONTII Wats. Bot. King, 287 (1871), type loc. North Platte River, *Fremont;* Cov. Contrib. U. S. Nat. Herb. 4: 179 (1893), 5: 95 (1897).

C. LEPTOPHYLLUM Nutt.; Moq. in DC. Prodr. 13^2: 71 (1849). Near C. fremontii; densely mealy or the leaves becoming green above; leaves linear, entire, acute, ½ to 1¼ inches long. Great Basin; to be expected on our eastern border; Lang, Los Angeles Co. acc. Parish, Bot. Gaz. 38: 460, but not reported since and perhaps an ephemeral introduction.

4. **C. botrys** L. JERUSALEM OAK. Erect, often widely branching, ½ to 2 feet high, glandular pubescent and viscid throughout; leaves slender-petioled, ovate to oblong, ½ to 1½ inches long, obtuse, truncate or cuneate at base, sinuately pinnatifid and the lobes usually toothed; spikes cymose, diverging, leafless; calyx not completely enclosing the achene.

Waste places near dwellings and in flood stream beds; naturalized from Europe and widely distributed but not common. July-Sept.

Ref.—CHENOPODIUM BOTRYS L. Sp. Pl. 219 (1753), type European.

5. **C. ambrosioides** L. MEXICAN TEA. Erect, 2 to 3½ feet high, usually stout and branched; herbage glabrous, scarcely glandular, when young sometimes tomentose-pubescent; leaves slightly petioled, oblong or lanceolate, 2 to 5 inches long, repand-toothed or nearly entire, the upper tapering to both ends; flowers in dense axillary clusters upon the branches, forming a leafy spike; calyx-lobes obtuse, appressed, slightly carinate, completely enclosing the achene; styles 3, sometimes 4; pericarp deciduous; seed smooth and shining, reddish, obtusely margined.

Common near salt marshes and abundant along interior streams; naturalized from tropical America; mostly autumnal. Great Valley and Coast Ranges to Southern California.

Ref.—CHENOPODIUM AMBROSIOIDES L. Sp. Pl. 219 (1753), type loc. Mexico.

6. **C. anthelminticum** L. WORMSEED. Very close to the preceding; sometimes biennial or perennial; herbage light green, glandular-puberulent and highly aromatic; leaves sinuate-serrate or the lower sometimes laciniate-pinnatifid, $\frac{3}{4}$ to 3 inches long; inflorescence a terminal mostly leafless panicle of dense but elongated slender spikes; sepals not carinate.

Not so common as the last, but appearing to hybridize with it. Naturalized from tropical America. Coast Ranges and Sacramento Valley.

Ref.—CHENOPODIUM ANTHELMINTICUM L. Sp. Pl. 220 (1753), type loc. Pennsylvania.

7. **C. carinatum** R. Br. Stems several from the base, ascending or decumbent, 5 to 13 inches long; herbage puberulent, the under side of the leaves with minute resin-globules; leaves ovate, sinuate-crenate, 3 to 6 lines long, on slender petioles $\frac{1}{2}$ to as long; flowers small, the clusters in all the axils; stamen usually 1.

Naturalized from Australia. Ione; Jackson; etc.

Ref.—CHENOPODIUM CARINATUM R. Br. Prod. 407 (1810), type loc. Australia.

8. **C. californicum** Wats. SOAP PLANT. Stout, erect or decumbent at base, $1\frac{1}{2}$ to $2\frac{1}{2}$ feet high from a very large carrot-like root; herbage green, scarcely at all mealy; leaves broadly triangular, truncate or cordate at base, or subhastate, sharply and unequally sinuate-dentate, $1\frac{1}{2}$ to $3\frac{1}{2}$ inches long; flowers in dense clusters in a terminal spike, leafless or leafy at the very base; calyx campanulate, barely exceeding 1 line; achene with persistent pericarp, subglobose or somewhat compressed, exserted, $\frac{3}{4}$ to 1 line broad; embryo completely annular.

Stream beds and moist slopes or swales in open foothills: Coast Ranges; Sierra Nevada foothills; south to San Diego Co. Apr.-May. The root is grated on a rock by the native tribes and used as a soap.

Locs.—Marysville Buttes, *Jepson;* Napa Co., *Jepson;* Marin Co., *Jepson;* Antioch, *Chesnut & Drew;* Berkeley, *Jepson;* Pacific Grove, *Tidestrom;* San Luis Obispo, *Roadhouse;* Antelope Valley, *Davy* 2270; San Bernardino, *Parish* 4379; Cajon Pass, north slope, *Hall* 6215; Menifee, *Alice King.*

Refs.—CHENOPODIUM CALIFORNICUM Wats. Bot. Cal. 2: 48 (1880); Blochman, Erythea, 2: 10 (1894); Jepson, Fl. W. Mid. Cal. 177 (1901). *Blitum californicum* Wats. Proc. Am. Acad. 9: 101 (1874), type from California.

9. **C. rubrum** L. RED GOOSEFOOT. Stem angled, erect, 1 to 2 feet high; herbage green or nearly so; leaves lanceolate-oblong to broadly ovate, coarsely sinuate, 1 to 2 inches long; flowers numerous in dense short axillary spikes; calyx-lobes 2 to 4, rather fleshy; stamens 1 or 2; achene shining, the margin acute.

Sparingly naturalized from Europe, in low and marshy lands: Lower Sacramento River; Alvarado Marshes; Nigger Slough and Ballona, Los Angeles Co. Sept.

Ref.—CHENOPODIUM RUBRUM L. Sp. Pl. 218 (1753), type European.

10. **C. capitatum** Asch. STRAWBERRY BLITE. Branched at base with erect or ascending stems 5 to 15 inches high; leaves hastate-triangular or -lanceolate, irregularly toothed or nearly entire, $\frac{3}{4}$ to 2 inches long, on margined petioles $\frac{1}{2}$ to as long; flower clusters large, in interrupted spikes, leafy below; stamens 1 to 5; calyx berry-like in fruit.

Sierra Co., acc. Bot. Cal.; Sisson, *Jepson.* North to Alaska, east to the Atlantic.

Refs.—CHENOPODIUM CAPITATUM Asch. Fl. Brandenb. 572 (1864). *Blitum capitatum* L. Sp. Pl. 4 (1753), type European.

Jepson, Fl. Cal. vol. 1, pp. 369-432, 31 Dec. 1913.

5. ROUBIEVA Moq.

Heavy-scented herb, with prostrate branches. Leaves alternate, deeply pinnatifid. Flowers minute, perfect or pistillate, solitary or 2 or 3 together in the axils; calyx deeply bowl-shaped, 3 to 5-toothed, becoming saccate and contracted at the top, enclosing the fruit. Stamens 5, included. Ovary glandular at the top; styles 3, somewhat lateral, exserted. Pericarp of the achene membranous, glandular-dotted, thin and deciduous; seed lenticular; embryo annular.—One species, South America. (G. J. Roubieu, French botanist.)

1. **R. multifida** Moq. Branches 1 to 2 feet long; leaves ½ to 1¼ inches long; calyx in fruit obovate, very conspicuously reticulate-veined.

Native of Peru; abundant on the San Francisco sand hills, and in waste places eastward to the Great Valley.

Refs.—ROUBIEVA MULTIFIDA Moq. Ann. Sc. Nat. ser. 2, 1: 293, t. 10, fig. b (1834). *Chenopodium multifidum* L. Sp. Pl. 220 (1753).

6. MONOLEPIS Schrad.

Low annuals with alternate fleshy leaves. Flowers polygamous, clustered in the upper axils. Sepal 1, entire, bract-like, persistent. Stamen 1. Styles 2, filiform. Achene with thin pericarp. Embryo annular around copious endosperm.—Species 3; western North America. (Greek monos, one, and lepis, scale, referring to the solitary sepal.)

Pericarp minutely pitted, adherent to the seed........................1. *M. nuttalliana.*
Pericarp minutely papillose, separating from the seed...................2. *M. spathulata.*

1. **M. nuttalliana** Greene. Pale green, branched at the base, the many stems 5 to 10 inches high; leaves linear or lanceolate with a salient tooth on each side near the middle, ½ to 1 (or 1½) inches long, shortly petioled or the lower petioles elongated; flower clusters dense, often reddish; sepal fleshy, foliaceous, often much exceeding the achene; pericarp minutely pitted, ½ line broad.

Alkaline soil, occasional but widely distributed: Southern California to the Sacramento Valley and northern Sierra Nevada; east to the Great Plains. Apr.-May.

Locs.—Hat Creek, Shasta Co., *Hall* 4264; Dixie Mts., Lassen Co., *Baker & Nutting;* Mt. Ralston, *Hall* 4678; Donner Lake, *Heller* 6880; Cisco, *H. A. Walker* 1474; Alpine Co., *Hansen;* Leavitt Meadow, *Congdon;* Glenn Co., *Davy;* San Carlos Range, *Jepson* 2739; Bakersfield, *Davy* 2140; San Emigdio Cañon, *Davy* 2000; Menifee, *Alice King;* Riverside, *Hall* 5750; Colorado Desert, *Brandegee;* Capistrano, *Abrams* 3267.

Refs.—MONOLEPIS NUTTALLIANA Greene, Fl. Fr. 168 (1891). *Blitum nuttallianum* R. & S. Mant. 1: 65 (1822). *B. chenopodioides* Nutt. Gen. 1: 4 (1818), type loc. arid soils near the Missouri River. *Monolepis chenopodioides* Moq. in DC. Prodr. 13^2: 85 (1849); Wats. Bot. Cal. 2: 49 (1880).

2. **M. spathulata** Gray. Habit of the last; leaves oblanceolate or spatulate, entire, ½ to 1 inch long; sepal rarely exceeding the achene.

Northern Sierra Nevada from Sierra Co. (acc. Bot. Cal.) to Leavitt Meadow and Mono Pass; Panamint Mts. acc. *Coville.*

Refs.—MONOLEPIS SPATHULATA Gray, Proc. Am. Acad. 7: 389 (1868), type loc. Mono Pass; Wats. Bot. Cal. 2: 49 (1880); Cov. Contrib. U. S. Nat. Herb. 4: 179 (1893).

7. ATRIPLEX L. SALTBUSH.

Herbs or shrubs, usually mealy or scurfy with bran-like scales. Leaves alternate or opposite. Flowers monoecious or dioecious, in axillary clusters, or in simple or panicled spikes; staminate flowers with a regular 4 or 5-parted calyx, the pistillate consisting of a pistil enclosed between a pair of appressed foliaceous bracts, without calyx. Stigmas 2. Bracts either free or united, much enlarged in fruit, the margin usually becoming more or less expanded or foliaceous and the sides thickened, indurated, muricate or variously appendaged.—About 125 species, temperate and subtropic regions of the whole earth. (The ancient Latin name.)

A. Herbs; monoecious.

1. Annuals; inflorescence various.

Somewhat succulent and mealy; leaves petioled, the lower at least 1 inch long; staminate and pistillate flowers usually mixed in same cluster; bracts distinct or nearly so, ovate to rhombic.
Lower leaves opposite; flowers in naked or nearly naked spikes; mostly coastal.
Leaves mostly lanceolate; fruiting bracts 4 to 6 lines long............1. *A. patula.*
Leaves triangular-hastate or deltoid; fruiting bracts 1½ to 2 lines long.........2. *A. hastata.*
Leaves all alternate; interior species.
Leaves triangular-ovate; flowers in naked spikes; fruiting bracts 1 line long........3. *A. spicata.*
Leaves rhomboidal-hastate; flowers in axillary clusters; fruiting bracts 3 to 4 lines long ....4. *A. phyllostegia.*
Not succulent, commonly whitish scurfy; bracts more or less united and indurated and nut-like in fruit, the margins partly or wholly free, the sides smooth, toothed or appendaged.
Staminate and pistillate flowers mixed in axillary clusters; mostly small plants.
Stems woolly-pubescent, the branches opposite throughout or mostly so; prostrate plant; leaves mostly less than 1½ lines long..................5. *A. parishii.*
Stems scurfy or glabrate but not woolly, the branches alternate, at least above the base; leaves small, 3 to 6 (or 10) lines long; fruiting bracts ½ to 2 lines broad.
Decumbent plants.
Bracts narrowly margined at summit with 3 to 5 small herbaceous teeth....6. *A. microcarpa.*
Bracts narrowly margined and dentate all around.......7. *A. saltonensis.*
Erect or ascending plants.
Fruiting bracts with the margin toothed above the entire base.
Leaves cordate-ovate, sessile.......................8. *A. cordulata.*
Leaves oblong-lanceolate to ovate, short petiolate or mostly sessile.....9. *A. coronata.*
Fruiting bracts circular, with a toothed margin all around..10. *A. elegans.*
Staminate flowers in naked moniliform terminal spikes, the pistillate in axillary clusters; leaves mostly ½ to 1 inch long or less (except no. 13); commonly tall plants.
Plants erect, or mostly so, 2 to 3 feet high.
Leaves oblanceolate or lanceolate; fruiting bracts 1 line broad...11. *A. coulteri.*
Leaves broadly or deltoid-ovate; fruiting bracts 2½ to 3 lines broad.
Staminate spikes short, dense ....12. *A. argentea.*
Staminate spikes elongated, interrupted ....13. *A. expansa.*
Plants decumbent; fruiting bracts triangular....................14. *A. decumbens.*

2. Perennials; staminate flowers in terminal naked spikes, the pistillate in axillary clusters.

Interior species of alkaline flats; bracts toothed; spikes often moniliform.
Diffuse; leaves mostly sharply dentate............................15. *A. bracteosa.*
Erect and rather rigid; leaves entire............................16. *A. fruticulosa.*
Seaboard species; bracts entire; spikes usually dense.
Stems prostrate, wiry; fruiting bracts membranous, compressed.......17. *A. californica.*
Stems reclining, stout; fruiting bracts spongy, globose..............18. *A. leucophylla.*

B. Shrubs, or at least suffrutescent; dioecious.

Fruiting bracts without lateral wings.
Sides of fruiting bracts smooth, the margins entire or with very low teeth.
Fruiting bracts large, their margins free and more or less divergent.
Leaves entire, sessile or nearly so; fruiting bracts ovatish.
Fruiting bracts 3 to 5 lines long; leaves not cordate....19. *A. confertifolia.*
Fruiting bracts 1 to 1½ lines long; leaves cordate..........20. *A. parryi.*
Leaves coarsely toothed, petioled; fruiting bracts orbicular..21. *A. hymenelytra.*
Fruiting bracts small, their margins not divergent.
Branches terete; bracts united about to middle or above; axes of spikes filiform, pliable.
Bracts flattened, obscurely crenate; desert.............22. *A. lentiformis.*
Bracts convex, entire; coast............................23. *A. breweri.*
Branches striate-angled; bracts distinct but closely compressed; axes of spikes stouter, rigid...24. *A. torreyi.*
Sides of fruiting bracts crested or muricate, the margins laciniate or toothed.
Bracts flattened, united about ⅓..........................25. *A. polycarpa.*

Bracts thickish, spongy, united nearly to apex.......................26. *A. nuttallii.*
Fruiting bracts with 4 very conspicuous longitudinal wings or crests.
Wings crest-like, about 1 line broad..27. *A. linearis.*
Wings roundish, 3 to 5 lines broad...28. *A. canescens.*

Sect. I.—Herbs with pistillate and staminate flowers on the same plant; annuals (nos. 1-14) or perennials (nos. 15-18).

1. **A. patula** L. Spear Orache. Stout and succulent, erect, 10 to 18 inches high, with few ascending branches; herbage green, only the growing parts somewhat mealy; leaves (the lowest often opposite) lanceolate or linear, sometimes with hastate base; inflorescence more or less leafy at base; fruiting bracts rhombic- or lance-ovate, thick and subcoriaceous, united at base, 4 to 6 lines long, entire or toothed, the sides smooth or muricate.

Common in salt marshes along the coast; Southern California to San Francisco Bay and north to British Columbia. Seacoasts of northern hemisphere.

Refs. Atriplex patula L. Sp. Pl. 1053 (1753); Greene, Fl. Fr. 169 (1891).

2. **A. hastata** L. Fat-hen. Rather slender, with long (1 to 2½ feet) ascending branches; herbage mealy, scarcely succulent; leaves triangular-hastate or deltoid, entire or sinuate-dentate, 1 to 2 inches long, often as broad or broader, on petioles 3 or 4 lines long; flowers in dense terminal and lateral spikes 1 to 4 inches long; fruiting bracts orbicular or triangular-ovate, 1½ (or 2) lines long, united at the cuneate base, the sides mostly toothed-crested.

Common in salt marshes about San Francisco Bay and north to Washington. Atlantic seacoast. Europe. Bracts very variable as to size and either much or little toothed, or entire. Lateral angles of the deltoid leaves often prolonged into salient lobes.

Refs.—Atriplex hastata L. Sp. Pl. 1053 (1753), type European.

3. **A. spicata** Wats. Erect, 9 to 16 inches high; herbage scurfy, the stem below glabrate; leaves triangular-ovate, irregularly dentate or entire, cuspidate, 1 to 2 inches long, on petioles 1 to 6 lines long; flowers in a panicle of usually dense naked spikes; staminate calyx 4-parted; pistillate flowers nearly concealed by the staminate flowers; bracts in fruit little enlarged, ovate, acute, united to the middle or above, the apex free, the sides smooth or slightly ridged, 1 to 1½ lines long.

Low alkaline tracts of the interior valleys: Sacramento, San Joaquin and Santa Clara valleys. Occasionally exhibits a tendency to become dioecious.

Locs.—Willows, *Jepson*; Solano Co., *Jepson*; Danville, *Davy*; Mt. Diablo, *Jepson*; Warm Sprs., Alameda Co., *Jepson*; Livermore; Hollister, *Setchell*; Gilroy Valley, *Jepson*.

Refs.—Atriplex spicata Wats. Proc. Am. Acad. 9: 108 (1874), type loc. near Livermore Pass, *Brewer* 1190; Jepson, Fl. W. Mid. Cal. 178 (1901). *A. joaquiniana* Nelson, Proc. Biol. Soc. Wash. 17: 99 (1904).

4. **A. phyllostegia** Wats. Bushy-branching, 4 to 13 inches high; herbage finally glabrous, inclined to be reddish; leaves rhomboidal-hastate with acuminate lobes, ¾ to 1¼ inches long, shortly petioled or subsessile, the blade entire, often almost as broad as long; fruiting bracts ovate or lanceolate, 4 lines long, abruptly and somewhat reniformly enlarged at base with 2 (or 4) tubercles or short ridges on the sides.

Mohave Desert; upper San Joaquin Valley; Owens Valley. Nevada.

Locs.—Goshen, *Jepson* 2651; Kern Delta, *Davy* 2139; Owens Valley, *Jepson* 930b, 5120; Keeler, *T. Brandegee*; Barstow, *Jepson* 5190; Rabbit Sprs., Mohave Desert, *Parish Bros.*

Refs.—Atriplex phyllostegia Wats. Proc. Am. Acad. 9: 108 (1874). *Obione phyllostegia* Torr. in Wats. Bot. King. 291 (1871), type loc. between Truckee and Humboldt rivers, Nevada.

5. **A. parishii** Wats. Prostrate, grayish-scurfy and slightly pubescent; stems slender, 1 to 4 inches long, densely foliaceous; leaves opposite, sessile, broadly ovate, acute, 1 to 2 (or 4) lines long; fruiting bracts ovate-hastate, acute, wingless, or the pair of hastate lobes representing the wing.

Low saline spots: Solano Co.; Redondo acc. *Braunton;* Orange Co.; Palm Sprs.

Refs.—ATRIPLEX PARISHII Wats. Proc. Am. Acad. 17: 377 (1882), type loc. Almond (formerly Costa), *S. B. & W. F. Parish. A. depressa* Jepson in Greene, Pitt. 2: 304 (1892), type loc. Pellejo Hills, Solano Co.

6. **A. microcarpa** Dietr. Freely branching with very slender decumbent nearly glabrous branches 3 to 12 inches long; leaves thin, obovate, acute at base, abruptly acute at apex, slightly scurfy, 3 to 5 lines long, sessile or subsessile; fruiting bracts 1 line broad, the margins parallel above the acutish base and united nearly to the 3 (or 5)-toothed truncate summit, the convex sides 1 to 3-nerved, smooth or muricate.

San Pedro; San Diego; Santa Cruz and San Clemente islands; Lower California.

Refs.—ATRIPLEX MICROCARPA Dietr. Syn. Pl. 5: 536 (1852). *Obione microcarpa* Benth. Bot. Sulphur, 48 (1844), type loc. San Diego. *A. pacifica* Nelson, Proc. Biol. Soc. Wash. 17: 99 (1904).

7. **A. saltonensis** Parish. Stems somewhat decumbent, very leafy, 4 to 6 inches broad; herbage scurfy; leaves ovate to obovate, 3 to 5 lines long, shortly petioled; flowers axillary; bracts orbicular, 1 to 1½ lines broad with narrow margin dentate all around.

Mecca, Colorado Desert, *Parish* 8452 (type). Not otherwise known.

Ref.—ATRIPLEX SALTONENSIS Parish, Muhl. 9: 57 (1913).

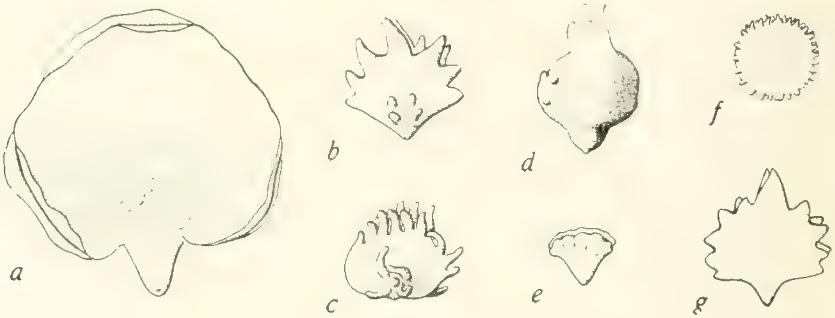

Fig. 82. Fruiting bracts of ATRIPLEX. *a*, A. HYMENELYTRA Wats.; *b*, A. FRUTICULOSA Jepson; *c*, A. ELEGANS Dietr.; *d*, A. LEUCOPHYLLA Dietr.; *e*, A. PARRYI Wats.; *f*, A. POLYCARPA Wats.; *g*, A. CORDULATA Jepson. All x 4.

8. **A. cordulata** Jepson. (Fig. 82g.) Erect, the simple stems or branches commonly virgate, 7 to 15 inches high, scurfy; leaves somewhat crowded, cordate-ovate, sessile, 3 to 4 lines long; calyx 4-parted; fruiting bracts fan-shaped or somewhat rhomboidal, 1½ to 2 lines broad, much compressed, pedicellate, the margin denticulate above the middle, the terminal tooth commonly the largest, sides smooth or bearing one or more tooth-like projections.

Alkaline flats, Sacramento and San Joaquin valleys.

Var. **tularensis** Jepson n. comb. More slender, taller (up to 2¼ feet), the leaves remoter, ovate and acuminate or lanceolate; fruiting bracts 1 line broad.—Bakersfield plains.

Refs.—ATRIPLEX CORDULATA Jepson in Greene, Pitt. 2: 304 (1892), type loc. Little Oak, Solano Co., *Jepson.* Var. TULARENSIS Jepson. *A. tularensis* Cov. Contrib. U. S. Nat. Herb. 4: 182, pl. 19 (1893), type loc. Bakersfield.

9. **A. coronata** Wats. Branching at the base, 3 to 12 inches high, sometimes rather stout, white-scurfy throughout; leaves oblong-lanceolate or ovate, sessile, 3 to 8 lines long; calyx 4-parted; fruiting bracts somewhat fan-shaped,

compressed, 2 lines long and as broad, the margins crenate-dentate above the middle, the sides rarely muriculate.

Saline flats: Solano Co. southward to Santa Clara Co. May-June.

Var. **notatior** Jepson n. var. Sides copiously toothed-crested, the fruits thus globose in outline.—(Fructus utrinque dentato-cristatus copiose ad hunc modum globosus.)—Dried-up lake bed, San Jacinto, *Jepson*.

Refs.—ATRIPLEX CORONATA Wats. Proc. Am. Acad. 9: 114 (1874), type loc. near Livermore Pass, *Brewer* 1189. *A. verna* Jepson in Greene, Pitt. 2: 305 (1892), type loc. Collinsville.

10. **A. elegans** Dietr. (Fig. 82f.) Scurfy, 3 to 10 inches high, with many ascending stems from the base; leaves obovate, usually entire, 4 to 10 lines long, sessile or the lowest petioled; fruiting bracts round, compressed, 1 to 1¾ lines broad, the somewhat convex center margined all around, the margin regularly and minutely toothed, the sides smooth.

Rabbit Sprs., Mohave Desert; Inyo Co. acc. *Coville;* Colorado Desert; east to New Mexico and south into Mexico.

Refs.—ATRIPLEX ELEGANS Dietr. Syn. Pl. 5: 537 (1852). *Obione elegans* Moq. in DC. Prodr. 13^2: 113 (1849), type from Sonora, Mex., *Coulter*. *A. fasciculata* Wats. Proc. Am. Acad. 17: 377 (1882), type loc. Fish Ponds, Mohave Desert, *S. B. & W. F. Parish*.

11. **A. coulteri** Dietr. Erect with very slender branches, 1 to 3 feet high, or sometimes diffusely spreading, the very base woody; leaves oblanceolate or lanceolate, ½ to 1 inch long, entire, mucronulate, sessile or the lowest petioled; fruiting bracts roundish, 1 line broad, with a narrow herbaceous laciniately toothed border which reaches nearly to the base, the convex sides reticulate-veiny, smooth or rarely muricate.

San Diego northerly to Capistrano and Ramona; Santa Catalina Island.

Refs.—ATRIPLEX COULTERI Dietr. Syn. Pl. 5: 537 (1852). *Obione coulteri* Moq. in DC. Prodr. 13^2: 113 (1849), type from California, *Coulter*.

12. **A. argentea** Nutt. SILVER ORACHE. Erect, branching, ½ to 1½ feet high, gray-scurfy or glabrate, the upper side of the leaves greener; leaves triangular-ovate or subhastate-ovate, acute, dentate or entire, ¾ to 1 inch long, shortly petioled, or the upper sessile; flowers in axillary clusters, the staminate in the upper axils or in spikes; fruiting bracts roundish, spongy-thickened, 3 lines long, with an herbaceous irregularly toothed margin above the short turbinate or pedicellate base, one or both the sides with herbaceous teeth or lamellae.

Inyo Co. acc. *Coville;* Siskiyou Co., *Butler* 1066, 1841; Sierra Co. acc. Bot. Cal.; north to Washington, east to the Rocky Mts.

Refs.—ATRIPLEX ARGENTEA Nutt. Gen. 1: 198 (1818), type loc. "saline places near the Missouri"; Wats. Bot. Cal. 2: 53 (1880); Cov. Contrib. U. S. Nat. Herb. 4: 180 (1893).

13. **A. expansa** Wats. FOG-WEED. Erect, much branched, 2 to 3½ feet high; finely mealy-scurfy; leaves broadly ovate or deltoid-ovate, irregularly and sharply toothed or entire, 1 to 3 inches long, often as broad as long, the lower on stout petioles 1 to 10 lines long and 3-nerved from the base, the upper reduced to sessile and more or less cordate floral bracts as broad as (or broader than) long; spikes elongated, slender; fruiting bracts sessile, roundish, mostly 3-nerved, 2 to 3 lines broad, the margin sharply toothed, the sides smooth or with a few irregular projections or crests.

Low alkaline areas of the interior: Sacramento Valley; south to Los Angeles and San Diego; east to New Mexico. Very abundant in the lower San Joaquin, a useful fodder plant if cut in May.

Locs.—San Joaquin Co., *Jepson;* upper San Joaquin Valley, *Davy* 2910; Santa Monica, *Parish Bros.;* Ramona, *K. Brandegee;* Westminister, Orange Co., *McClatchie*.

Refs.—ATRIPLEX EXPANSA Wats. Proc. Am. Acad. 9: 116 (1874), type loc. s.w. U. S. *A. nodosa* Greene, Pitt. 1: 40 (1887), from Antioch, is an insect-stung monstrosity. *A. trinervata* Jepson in Greene, Pitt. 2: 305 (1892), type loc. Araquipa Hills, Solano Co. Var. *mohavensis* Jones, Contrib. 11: 20 (1903), type loc. Mohave Desert to San Bernardino.

14. **A. decumbens** Wats. Stems trailing, 1 to 3 feet long; leaves alternate or the upper mostly opposite, finely hoary, ovate, 4 to 9 lines long, sessile; fruiting bracts triangular, truncate at base, 3 to 4 lines long, nearly as broad, united to the middle, the sides smooth; margins denticulate, their lower $\frac{1}{4}$ united.

Coast from San Diego to Long Beach; Santa Catalina Island.

Refs.—ATRIPLEX DECUMBENS Wats. Proc. Am. Acad. 12: 275 (1876), type loc. San Diego, *Palmer* 334. *A. watsonii* Nelson in Abrams, Fl. Los. Ang. 128 (1904).

15. **A. bracteosa** Wats. More or less diffuse, the stems 1 to several feet long; branches smooth and shining, straw-color; leaves finely grayish scurfy, greener above, oblong-ovate, mucronate-acute, or acuminate, $\frac{1}{2}$ to 2 inches long, thin, sharply but sparingly toothed or the smaller entire; fruiting bracts whitish, 1 to 1½ lines long, the herbaceous margin laciniately toothed, or simply dentate with the central tooth lanceolate and conspicuous.

Moist saline soil, Great Valley to Southern California. Aug.-Oct.

Locs.—Princeton, Colusa Co., *Chandler;* Tyler Island, lower Sacramento, *Jepson;* Visalia, *Congdon;* Bakersfield, *Davy* 2886; San Bernardino, *Parish* 4195; Los Angeles, *Braunton;* Riverside, *Hall;* Temescal Wash, *Jepson* 1578; Elsinore, *McClatchie;* San Diego, *K. Brandegee.*

Refs.—ATRIPLEX BRACTEOSA Wats. Proc. Am. Acad. 9: 115 (1874). *Obione bracteosa* Dur. & Hilg., Pac. R. Rep. 5^3: 13, pl. 14 (1855), type loc. Posé Creek, Kern Co., *Heermann. A. coronata* Jepson, Erythea, 1: 244 (1893), not Wats. *A. serenana* Nelson in Abrams, Fl. Los Ang. 128 (1904).

A. SEMIBACCATA R. Br. Prodr. 406 (1810). Diffusely spreading perennial, the stems woody below; leaves oblong, sinuate-toothed or entire, $\frac{1}{2}$ to 2 inches long; fruiting bracts rhomboidal, acute, stipe-like at base, united about one-half, toothed at the lateral angles, 2 to 3 lines long, smooth on the 3-nerved sides.—Native of Australia, cultivated as a forage plant and becoming spontaneous along the coast, especially southward, and in the Colorado Desert.

16. **A. fruticulosa** Jepson. (Fig. 82b.) Stems several from the base, erect, simple below, with terminal branchlets, 6 to 13 inches high, slightly woody at base; herbage grayish; leaves sessile, lanceolate or narrowly oblong, $\frac{1}{4}$ to $\frac{3}{4}$ inch long; fruiting bracts $1\frac{1}{2}$ to 2 lines long and about as broad, the margins toothed above the base, the sides tooth-crested.

Alkaline flats of the Great Valley from the "goose-lands" of Glenn Co. south into the San Joaquin.

Refs.—ATRIPLEX FRUTICULOSA Jepson in Greene, Pitt. 2: 306 (1892), type loc. Little Oak, Solano Co., *Jepson;* Fl. W. Mid. Cal. 180 (1901).

17. **A. californica** Moq. Stems from a fleshy fusiform root, slender, wiry, mostly herbaceous, prostrate, often much branched and forming a thick mat; herbage finely white-mealy, but the general hue mostly greenish; leaves thinnish, ovate-lanceolate to oblong-lanceolate, 2 to 7 lines long, sessile or shortly petioled; flowers in mixed axillary clusters, or the staminate mostly in terminal spikes; fruiting bracts membranous, ovate, acute, entire, loosely closed over the utricle, but not united, 1 to 2 lines long.

Sandy beaches or bluffs along the coast from Marin Co. to San Diego and Lower California. Apr.-May.

Locs.—Pt. Reyes, *Davy* 6764; Mare Island, *Greene;* West Berkeley, *Jepson;* San Francisco; Santa Cruz; Monterey; Redondo; Santa Barbara Islands (Zoe, 1: 144).

Refs.—ATRIPLEX CALIFORNICA Moq. in DC. Prodr. 13^2: 98 (1849), type from California, *Coulter;* Greene, Pitt. 1: 207 (1888); Jepson, Fl. W. Mid. Cal. 180 (1901).

18. **A. leucophylla** Dietr. (Fig. 82d.) Stems prostrate, often somewhat woody at base, 1 to several feet long, the branches usually many, short, ascending, very leafy, often almost imbricated-leafy; herbage densely scurfy, light brown, sometimes pinkish; leaves thick, orbicular to elliptic or elliptic-ovate, entire, 4 to 8 (or 12) lines long, sessile, 3-nerved; calyx rather large, 5-cleft; fruiting bracts subglobose, $1\frac{1}{2}$ to 2 lines long, with the bracts completely united and marginless (except at the apex where there is a small

ovate double wing) and the sides commonly with two (or several) warty projections.

Seabeaches, very common: San Francisco to Southern California and the Santa Barbara Islands. June-Dec.

Refs.—ATRIPLEX LEUCOPHYLLA Dietr. Syn. Pl. 5: 536 (1852). *Obione leucophylla* Moq. in DC. Prodr. 13²: 109 (1849), type from California, *Chamisso*.

Sect. II.—Shrubs, or at least woody at base, with staminate and pistillate flowers on different plants.

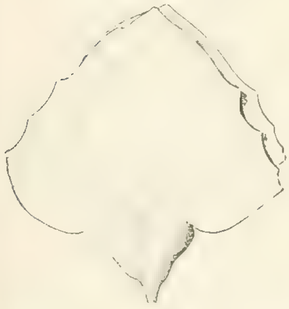

Fig. 83. ATRIPLEX CONFERTIFOLIA Wats.; fruiting bracts, x 4.

19. **A. confertifolia** Wats. SPINY SALTBUSH. (Fig. 83.) Compact round bushes 1 to 2 feet high, more or less spiny; flowers in subpaniculate spikes, in fruit very dense; leaves ovate or elliptic, entire, rounded at apex, abruptly cuneate at base, 3 to 8 lines long, very shortly petioled; fruiting bracts sessile, round-ovate or subdeltoid, acutish or mostly obtuse, truncate or subcordate at base, 4 to 10 lines long, entire or sometimes dentate, united around the seed, the dilated margins otherwise free and more or less spreading, the sides smooth.

Common on mesas and hills of the Mohave Desert: North to Inyo and Lassen cos.; east to Colorado, thence south to Mexico. Not in the Colorado Desert.

Locs.—Antelope Valley, *Davy*; Barstow, *Jepson* 4783, 5170; Owens Lake, *Jepson* 5132; Honey Lake Valley, *Davy* 3274.

Biol. Note.—After losing their fruits the branches of the short panicle become rigid and spinescent. Such naked spiny branches persist for several years and provide considerable protection for the bush against the attacks of grazing animals. All the shrubby species exhibit similar characteristics in greater or less degree, but in none other of our species is the spininess so effectively developed as in A. confertifolia.

Refs.—ATRIPLEX CONFERTIFOLIA Wats. Proc. Am. Acad. 9: 119 (1874). *Obione confertifolia* Torr. & Frem. in Frem. Sec. Rep. 318 (1845), type loc. Salt Lake, Utah.

20. **A. parryi** Wats. PARRY SALTBUSH. (Fig. 82e.) Densely branching white-scurfy rounded bush 8 to 16 inches high, near the preceding but the rigid spinosely tipped branches more numerous and slenderer; leaves thick, round-cordate, obtuse or acute, sessile, 2 to 6 lines broad; flower-clusters axillary; fruiting bracts very small ($\frac{3}{4}$ to $1\frac{1}{2}$ lines long), somewhat fan-shaped, united to above the middle, abruptly dilated above the broadly cuneate base, the free margin short but broad and with a few low teeth, the sides smooth.

Antelope Valley and northeasterly through the Mohave Desert to Owens Lake and Lone Pine, *Jepson* 5145, 5149; Death Valley and southern Nevada acc. *Coville*.

Refs.—ATRIPLEX PARRYI Wats. Proc. Am. Acad. 17: 378 (1882), type loc. Lancaster, *Parry*; Cov. Contrib. U. S. Nat. Herb. 4: 181 (1893); Merriam, N. Am. Fauna, 7: 325 (1893); Parish, Zoe, 5: 113 (1901).

21. **A. hymenelytra** Wats. DESERT HOLLY. (Fig. 82a.) Compactly branching, 1 to 3 feet high, the stems from thickened and often very gnarled woody bases 1 inch in diameter; herbage covered with dense smooth silvery-white scurf; leaves roundish, $\frac{1}{2}$ to $1\frac{3}{4}$ inches broad, somewhat cordate at base, the undulate margin with coarse salient teeth, the petioles 3 to 6 lines long; flower clusters in panicled spikes; fruiting bracts on a short clavate pedicel, round-reniform, strongly flattened, entire, $2\frac{1}{2}$ to 6 lines broad, distinct or nearly so, the margins entirely free and sides smooth.

Colorado and Mohave deserts north to Owens Valley; east to Utah. Also called Silver Holly.

Refs.—ATRIPLEX HYMENELYTRA Wats. Proc. Am. Acad. 9: 119 (1874). *Obione hymenelytra* Torr. Pac. R. Rep. 4: 129, pl. 20 (1856), type loc. Williams River, Ariz.

22. **A. lentiformis** Wats. Quail Brush. (Fig. 84.) Widely spreading shrub 6 to 10 feet high and half again as broad; branches divaricate, occasionally spinescent; herbage closely scurfy; leaves ovate or triangular-hastate, rounded at apex, ½ to 1½ inches long, on short petioles; fruiting spikes dense, naked, pliable, in compact panicles, 4 to 8 inches long; calyx 5-cleft; fruiting bracts roundish, flattened, 1 to 2 lines broad, united by their edges to the middle or above, the sides smooth and the free margins obscurely crenulate.

Alkaline flats and river benches: upper San Joaquin Valley; Mohave and Colorado deserts; Arizona.

Locs.—Upper San Joaquin Valley, *Eastwood*; Chemehuevis Valley, Colorado River, *Jepson* 5197; Whipple Mts., *Jepson* 5217; Colorado Desert, *Parish* 8265 (Dos Palmos), 8264 (Mecca).

Refs.—Atriplex lentiformis Wats. Proc. Am. Acad. 9: 118 (1874). *Obione lentiformis* Torr. in Sitgreaves Exped. 169, pl. 14 (1853), type loc. Colorado River, Cal.

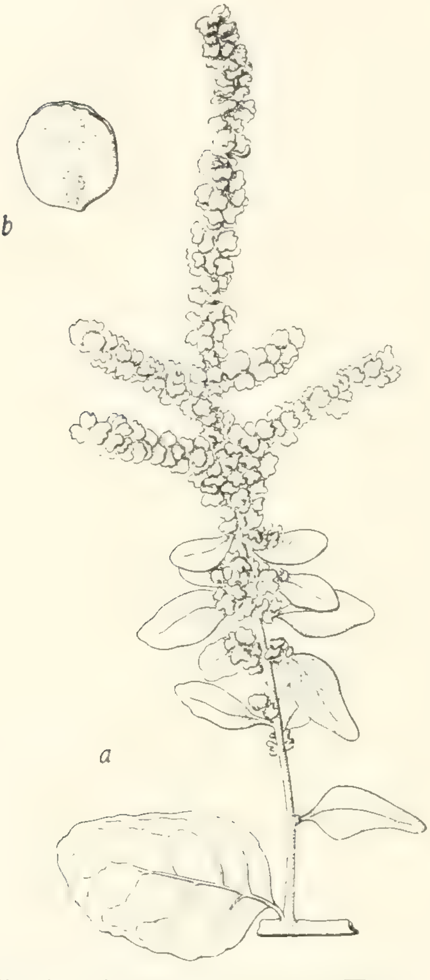

Fig. 84. Atriplex lentiformis Wats. *a*, fruiting branch, x 1; *b*, fruiting bracts, x 4.

23. **A. breweri** Wats. Very near preceding, 4 to 6 feet high; calyx 4-cleft; fruiting bracts spongy, drab-color, rounded, somewhat convex, united to near the middle, entire, 1½ to 3 lines broad.

Coast from Santa Barbara to Santa Monica and San Juan Capistrano. Santa Cruz Island.

Refs.—Atriplex breweri Wats. Proc. Am. Acad. 9: 119 (1874), types from Santa Monica and Santa Barbara; Parish, Erythea, 7: 91 (1899). *A. orbicularis* Wats. Proc. Am. Acad. 17: 377 (1882), type loc. Santa Monica.

24. **A. torreyi** Wats. Nevada Saltbush. Leafy bush 2 to 5 feet high, densely and divaricately branched, the branches striately angled, somewhat spiny with the lateral axes of the old panicles; leaves ovate-hastate or broadly oblong, ½ to 1½ inches long on petioles 1 to 4 lines long; flowers in narrow panicles; fruiting bracts roundish or transversely elliptic, 1½ to 2 lines broad, distinct, strongly compressed, with denticulate (sometimes smooth) margins and smooth veiny sides.

Alkaline desert flats: Mohave Desert; Inyo Co.; Nevada; east to Utah.

Locs.—Barstow, *Jepson* 4791, 5174, 5434; Lone Pine, *Jepson* 5146.

Refs.—Atriplex torreyi Wats. Proc. Am. Acad. 9: 119 (1874). *Obione torreyi* Wats. Bot. King, 5: 290 (1871), types from dry valleys of the Truckee and Carson rivers, Nev.

25. **A. polycarpa** Wats. Cattle Spinach. (Fig. 82e.) Light-gray shrub 2 to 3½ feet high, with slender rigid branches and numerous more or less spiny branchlets; leaves thick, obovate to oblong-spatulate, obtuse, sessile,

those of the vegetative branches 4 to 7 or 10 lines long, deciduous during the high heat period, those of the fruiting branches very small (1 to 4 lines long), with smaller ones fascicled in the axils; flowers in close naked panicled spikes; fruiting bracts roundish, united about ⅓, 1 to 2 lines broad, commonly broader than long, laciniately or unequally toothed, the sides with 2 or more slender spreading teeth or tubercular crests or sometimes quite smooth.

Desert bottoms and flats and river benches: Colorado and Mohave deserts; north to Inyo Co.; San Joaquin Valley; Arizona. Fl. June; fr. Sept.-Oct.

Locs.—Calexico, *Parish* 8261; Mecca, *Parish* 8262; Whipple Mts., *Jepson* 5215; Barstow, *Jepson* 4800, 5173; Owens Lake, *Jepson* 5104; Alabama Hills, *Jepson* 918; Bakersfield, *Davy* 2137, 2402, 2884; Los Baños, *Grinnell.*

Refs.—ATRIPLEX POLYCARPA Wats. Proc. Am. Acad. 9: 117 (1874); Merriam, N. Am. Fauna, 7: 325 (1893). *Obione polycarpa* Torr. in Emory, Mil. Reconn. 150 (1848), type loc. Williams River, Ariz.

26. **A. nuttallii** Wats. NUTTALL SALTBUSH. Diffuse shrub 1 to 2 feet high; leaves obovate to oblong or linear, entire, narrowed to a short petiole or sessile, 1 to 2 inches long; flowers in sparingly naked panicled spikes; fruiting bracts ovate, convex, united except at apex, 2 to 5 lines long, sessile or raised on a pedicel 2 lines long, the margin commonly 3-toothed at apex, the middle tooth often largest and the lateral small or wanting, the sides irregularly and often copiously tooth-crested.

Honey Lake Valley, Lassen Co., *Davy:* east to the Rocky Mts.

Ref.—ATRIPLEX NUTTALLII Wats. Proc. Am. Acad. 9: 116 (1874), type west American.

27. **A. linearis** Wats. Shrub, more woody than A. nuttallii; leaves linear or narrowed towards the base, ½ to 1½ inches long; staminate flowers in small globose clusters, in simple or panicled spikes, leafy below; pistillate flowers solitary or few together in similar spikes, more leafy; fruiting bracts lanceolate or ovate, 2 to 4 lines long, prolonged above into a narrow tip, the sides irregularly tuberculate or crested and developing 4 deeply toothed wings.

Colorado Desert; south into Mexico.

Locs.—Durmid, *Parish* 8073. Referred here provisionally are plants of the Argus Mts., Inyo Co., *Purpus* 5409, or these may belong to *A. aptera* Nelson (Bot. Gaz. 34: 356,—1902, type loc. Laramie).

Refs.—ATRIPLEX LINEARIS Wats. Proc. Am. Acad. 24: 72 (1889), type loc. Guaymas, Sonora, *Palmer* 120, 121, 235.

28. **A. canescens** James. SHAD-SCALE. (Fig. 85.) Roundish gray shrub 1 to 5 feet high; leaves linear, entire, narrowed at base, ¾ to 1¼ inches long, finely scurfy-canescent; flowers mostly dioecious in elongated narrow spike-like panicles, very dense in fruit; fruiting bracts forming a thick hard body 2 to 4 lines long, tipped at apex with 2 lanceolate teeth 1 line long and laterally margined by 4 roundish very conspicuous wings 3 to 6 lines long and 2 to 4 lines broad; wings decurrent at base on the pedicel and overtopping the free apex, the margin irregularly dentate or laciniate.

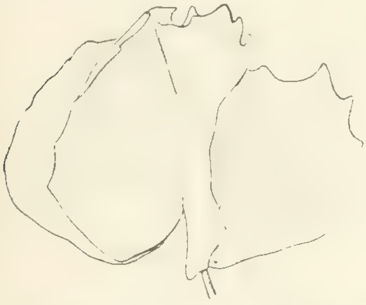

Fig. 85. ATRIPLEX CANESCENS James: fruiting bracts, x 4.

Desert flats or washes, Mohave and Colorado deserts west to San Bernardino and San Diego; east to Nevada and Dakota and south into Mexico.

Locs.—San Diego, *Palmer;* Imperial, *Parish* 8259; San Bernardino, *Parish;* Barstow, *Jepson* 5171; Argus Mts., *Hall & Chandler*, 7067; Owens Lake, *Jepson* 5105; Colorado River near Williams Fork, *Jepson* 5225; Holtville, *Parish* 8077.

Very variable in its fruiting bracts. The original or Great Plains plant has densely scurfy wings. Along the Colorado River are plants with very broad and only slightly scurfy fruit wings. With their slender branches crowded with sea-green fruits and bending outwards or towards the ground, these shrubs are not unhandsome objects and are somewhat different in appearance from many forms of the Mohave and Colorado deserts with scurfy fruits and often much reduced or toothed wings.

Var. **laciniata** Parish n. var. Wings 3 or 4 lines broad, saliently laciniate. —(Alae lin. 3-4 latae, profunde laciniatae.)—Caleb, Colorado Desert, *Parish* 8256. Also occurring in the Mohave Desert (Barstow, *Jepson* 5171a). Passing into the next.

Var. **macilenta** Jepson n. var. Wings much reduced, ¾ to 1½ lines broad, coarsely toothed.—(Alae perminutae, lin. ¾-1½ latae, dentatae.)—Holtville, Colorado Desert, *Parish* 8258. Not uncommon in the southern part of the Colorado Desert. Aspect very different from the type.

Refs.—ATRIPLEX CANESCENS James, Cat. 178 (1825); Merriam, N. Am. Fauna, 7: 326 (1893). *Calligonum canescens* Pursh, Fl. 2: 370 (1814), type loc. Big bend of the Missouri.

8. **GRAYIA** H. & A.

Low shrubs with alternate entire leaves. Flowers dioecious or sometimes monoecious, in axillary clusters or terminal spikes. Staminate flowers without bracts; calyx mostly 4-parted; stamens 4 or 5, with short subulate filaments. Pistillate flowers without calyx, the ovary enclosed in an orbicular strongly flattened membranous sac with a small orifice at the apex and bordered all around with a narrow wing; sac really composed of 2 conduplicate bracts united by their edges nearly to the apex, each bract with a wing developed on the back or midrib, the whole much enlarged in fruit. Styles 2. Achene with very thin pericarp.—Two species, Great Basin region. (Asa Gray, 1810-1888, distinguished American botanist.)

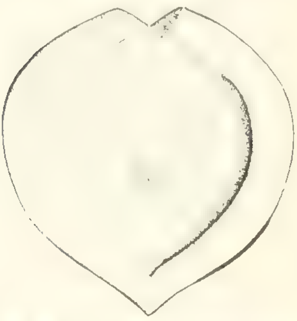

Fig. 86. GRAYIA SPINOSA Moq.; fruiting bracts, x 4.

1. **G. spinosa** Moq. HOP SAGE. (Fig. 86.) Deep green shrub 1¼ to 3 feet high, the branches frequently spinescent; young parts mealy, finally glabrous; leaves rather fleshy, linear-oblanceolate or obovate, 4 to 15 lines long, barely petioled; staminate flowers in axillary clusters, the pistillate mostly spicate; fruiting bracts round, 3 to 6 lines in diameter, sessile, entire, glabrous, thin, white or pinkish, emarginate, abruptly narrowed below to a short cuneate pedicel-like base, or the pedicel often obscure or obsolete; styles slender, at first exserted.—Alkaline valleys: Mohave Desert to Owens Valley; north to Washington and east to Wyoming.

Locs.—Antelope Valley, *Hall* 3036; Barstow, *Jepson* 4833; Panamint Mts., *Hall & Chandler* 6992; Big Pine, *Hall & Chandler* 7227; Argus Mts., *Purpus* 5481; Honey Lake Valley, *Dacy* 3273.

Refs.—GRAYIA SPINOSA Moq. in DC. Prodr. 13^2: 119 (1849); Merriam, N. Am. Fauna, 7: 328 (1893). *Chenopodium ? spinosum* Hook. Fl. Bor. Am. 2: 127 (1838), type loc. Columbia River basin, *Douglas*. *Grayia polygaloides* H. & A. Bot. Beech. 388 (1840); Hook. Icon. Pl. 3, pl. 271 (1840); Kennedy, Univ. Nev. Agr. Exp. Bull. 55: 36 (1903).

9. **EUROTIA** Adans.

Low white-tomentose shrubs with alternate entire leaves. Flowers dioecious or monoecious, in small axillary clusters, the clusters spicately disposed at the ends of the branches. Staminate flowers without involucral bracts; calyx hairy, 4-parted; stamens 4, exserted. Pistillate flowers without calyx; pistil enclosed in a membranous densely silky-hairy sac composed of two bracts united above the middle and with spreading apices; styles 2, slender, exserted.

Sac in fruit enlarged, 4-angled, beaked above by two short horns.—Two species, the second in Europe-Asia. (Greek euros, mould, referring to the hairy or rufous covering.)

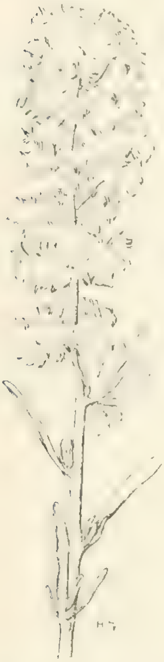

Fig. 87. Eurotia lanata Moq.; fruiting branchlet, x 1.

1. **E. lanata** Moq. Winter Fat. (Fig. 87.) Branches slender, usually many from the woody stems, 1 to 2 feet high, the herbage stellately white-tomentose or in age reddish; leaves linear with strongly revolute margins, ¾ to 1¼ inches long or the axillary fascicled ones mostly 1 to 6 lines long; fruiting involucre 2 or 3 lines long, ornamented with 4 dense spreading tufts of silvery-white hairs; ovary densely white-hairy.

Subalkaline soils of the Colorado and Mohave deserts; upper San Joaquin Valley (Rosamond, Sunset) and the neighboring inner Coast Range at Goodwin; Owens Valley north to Honey Lake Valley; east to New Mexico and far northward to Washington and Saskatchewan. Often abundant in the desert valleys and prized by the cattlemen for winter forage; they sometimes call it "White Sage" or "Sweet Sage."

Refs.—Eurotia lanata Moq. Enum. Chenop. 81 (1840); Cov. Contrib. U. S. Nat. Herb. 4: 182 (1893); Brandegee, Zoe, 4: 159 (1893); Kennedy, U. S. Dept. Agr. Div. Agros. Bull. 22: 84 (1900); Merriam, N. Am. Fauna, 7: 329 (1893). *Diotis lanata* Pursh, Fl. 2: 602 (1814), type loc. open prairies, Missouri River, *Capt. Lewis.*

10. KOCHIA Roth.

Perennial herbs, woody at very base. Leaves linear, terete, entire. Flowers perfect, solitary or few in the axils of the virgate leafy stems, without bracts. Calyx herbaceous, subglobose, shortly 5-lobed, persistent over the fruit, and finally developing 5 horizontal wings. Stamens 5, usually exserted. Ovary depressed; styles 2 or 3, filiform. Achene with membranous persistent pericarp. Embryo nearly annular, green; endosperm none.—About 30 species in the Old World (all continents) and 2 in N. Am. (W. D. J. Koch, one time Director of the Botanic Garden at Erlangen.)

Herbage grayish or glabrate; leaves ascending............................1. *K. americana.*
Herbage grayish or rusty; leaves spreading............................2. *K. californica.*

1. **K. americana** Wats. Stems many from the branching crown of a woody root, erect, 5 to 11 inches high; stems whitish-tomentulose, the leaves silky-pilose, both finally glabrate and greenish; leaves narrowly linear, 4 to 7 lines long, ascending or strict; calyx densely white-tomentose or partly glabrate; wings fan-shaped, membranous, striate, toothed or erosulate, 1 line long.

Desert valleys: Honey Lake Valley; Inyo Co.; east to Colorado.

Refs.—Kochia americana Wats. Proc. Am. Acad. 9: 93 (1874); Nelson, Coulter's New Man. Rocky Mts. 164 (1909).

2. **K. californica** Wats. Stems many from a branched woody crown, erect, branching, 6 to 15 inches high; both stem and leaves rusty or grayish with a dense silky tomentum; leaves narrowly oblong, spreading, 2 to 6 lines long; calyx densely tomentose; fruiting calyx not seen.

Western Madera Co.; Bakersfield; Mohave Desert from Desert Well (Iron Mt.) west to Rabbit Sprs. and Antelope Valley. Ash Meadows, Nevada, acc. *Coville.*

Refs.—Kochia californica Wats. Proc. Am. Acad. 17: 378 (1882), types from Lancaster, *Parry,* and Rabbit Sprs., Mohave Desert, *S. B. & W. F. Parish;* Parish, Zoe, 5: 113 (1901).

11. **SPIROSTACHYS** Wats.

Shrub with alternate leafless jointed branches; the branchlets fleshy and green with short scale-like leaves. Flowers perfect, arranged spirally by threes in a crowded spike, in the axils of fleshy subsessile bracts. Calyx of 4 (or 5) concave carinate imbricated sepals, more or less united. Stamens 1 or 2, with slender filaments at length exserted. Ovary oblong; styles 2, rarely 3, commonly distinct. Achene with membranous pericarp, free from the vertical oblong seed. Embryo green, nearly surrounding the rather copious endosperm.—Three species, 2 in S. Am. (Greek speira, a coil or spiral, and stachus, a spike.)

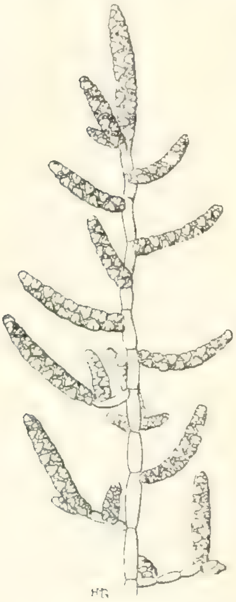
Fig. 88. SPIROSTACHYS OCCIDENTALIS Wats.; flowering spikes, x 1.

1. **S. occidentalis** Wats. IODINE BUSH. (Fig. 88.) Erect, diffusely branched, 2 to 4 feet high; vestiges of leaves very short, broadly triangular and amplexicaul, acute, often nearly obsolete; spikes numerous, sessile or nearly so, cylindrical, 3 to 10 lines long; bracts rhomboidal; flowers crowded, slightly exserted; calyx becoming spongy and enclosing the fruit.

Moist alkaline clay soil: San Joaquin Valley; Inyo Co. south to Chemehuevis Valley on the Colorado River, east to Texas. Very abundant in the upper San Joaquin Valley.

Refs.—SPIROSTACHYS OCCIDENTALIS Wats. Proc. Am. Acad. 9: 125 (1874). *Halostachys occidentalis* Wats. Bot. King, 293 (1871), type from the Great Basin. *Allenrolfea occidentalis* Ktze. Rev. Gen. Pl. 546 (1891); Jepson, Fl. W. Mid. Cal. 181 (1901).

12. **SALICORNIA** L. SAMPHIRE. GLASSWORT.

Low very succulent herbs with jointed stems and opposite terete branches. Leaves reduced to mere opposite scales at the nodes, the flowers immersed in the axils of the scales of the thickened upper joints and forming a cylindrical spike. Flowers disposed in opposite clusters of 3, all perfect or the lateral ones of each trio often only staminate. Calyx small and bladder-like, with an anterior opening, in fruit spongy and deciduous. Stamens 2, exserted in flower. Ovary oblong; styles 2 or 3, short. Achene with membranous pericarp, adherent to the seed. Embryo folded, the cotyledons incumbent upon the caulicle; endosperm none or almost none.—Ten species, all continents. (Latin sal, salt, and cornu, horn, plants of saline habitat with horn-like branches.)

Perennial by rootstocks; flowers of a trio all of the same height.
  Spikes slender, narrower than stems....................................1. *S. ambigua.*
  Spikes rather thicker than stems....................................2. *S. subterminalis.*
Annuals; middle flower higher than the lateral.
  Joints of spikes longer than broad....................................3. *S. europaea.*
  Joints of spikes broader than long....................................4. *S. mucronata.*

1. **S. ambigua** Michx. PICKLE-WEED. (Fig. 89.) Stems erect, or decumbent and rooting at the joints, 5 to 12 inches long, from woody rootstocks; herbage greenish; internodes rather long; spikes slender, usually narrower than the stem, all the scales flower-bearing to the top; achene pubescent.

Salt marshes along the coast: San Francisco and Suisun bays south to San Pedro and Lower California, north to British Columbia. Atlantic coast.

Ref.—SALICORNIA AMBIGUA Michx. Fl. Bor. Am. 1: 2 (1803), type loc. the Carolinas.

2. **S. subterminalis** Parish. Stems widely spreading or erect and compact, ½ to 1 foot high, from running rootstocks; internodes short; branchlets very

numerous, each pair often turned to one side, giving the stem a unilateral appearance; spikes 1 to 2 inches long, of few to several enlarged broad flower-bearing scales and terminated by about as many long slender sterile ones; achene glabrous.

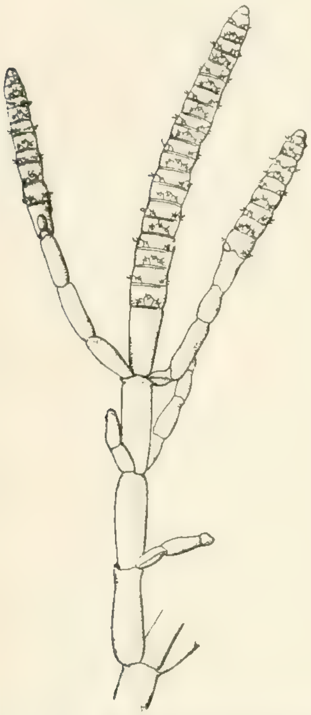

Fig. 89. Salicornia ambigua Michx.; flowering spikes, x 1.

Santa Monica to San Diego, east to Menifee and Perris and north to Bakersfield.

Refs.—Salicornia subterminalis Parish, Erythea, 6: 87 (1898), type loc. western Riverside Co., *Parish* 1520, 4463; l. c. 7: 92 (1899); Abrams, Fl. Los Ang. 130 (1904).

3. **S. europaea** L. Erect compactly branching annual 3 to 9 inches high; spikes slender, 1 line wide, mostly tapering toward tip, the joints much longer than broad; scales with blunt or very shortly acute tips; middle flower much higher than the lateral, shorter than the joints; fruiting calyx with raised spongy margin about a central crest.

Alkaline marshes, chiefly in the desert region: San Diego; Tehachapi Valley, acc. *Coville*; Modoc Co.; Palo Alto. Atlantic coast; Europe; Asia.

Ref.—Salicornia europaea L. Sp. Pl. 3 (1753). *S. herbacea* L. Sp. Pl. ed. 2, 1: 5 (1762); Parish, Erythea, 7: 91 (1899).

4. **S. mucronata** Bigel. Habit of the preceding; spikes thick-cylindric, 2½ to 3 lines broad, not tapering, the joints broader than long; scales with acuminate points; middle flower half higher than the lateral, occupying the whole joint; fruiting calyx with flattish anterior face.

San Diego; east to the Atlantic.

Refs.—Salicornia mucronata Bigel. Fl. Bost. ed. 2, 2 (1824), type loc. e. Mass. *S. bigelovii* Torr. Bot. Mex. Bound. 184 (1859).

13. SARCOBATUS Nees.

Rigid and divaricately branched compact shrub with somewhat thorny branches. Leaves alternate, linear, sessile, entire. Flowers monoecious or dioecious, without bracts. Staminate flowers in terminal catkin-like spikes without calyx and with spirally arranged scales; stamens 2 to 5 under a stipitate peltate scale; filaments short. Pistillate flowers axillary and com-

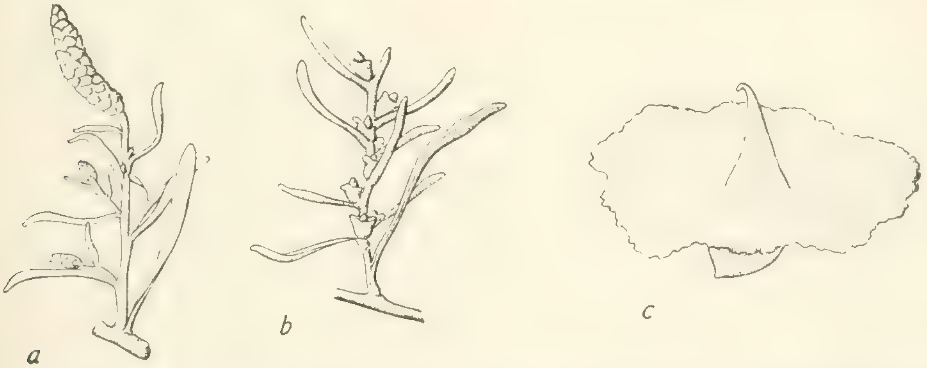

Fig. 90. Sarcobatus vermiculatus Torr. *a*, staminate inflorescence, x 1; *b*, pistillate inflorescence, x 1; *c*, fruit, x 4.

monly solitary, sessile; ovary set in a sac-like adherent calyx; style short; stigmas 2, spreading horizontally; calyx laterally margined by a narrow border which becomes in fruit a broad circular horizontal wavy membranous wing.—One species, western N. Am. (Greek sarcx, flesh, and batos, thicket.)

1. **S. vermiculatus** Torr. BLACK GREASEWOOD. (Fig. 90.) Branches closely interlocking, 3 to 5 feet high; bark white; leaves $\frac{1}{2}$ to $1\frac{3}{4}$ inches long, fleshy, flat on the upper side, rounded beneath, usually glabrous; staminate spikes 7 to 10 lines long; fruiting calyx with prominently veined wing, 4 to 6 lines broad.

Alkaline clay soil of desert valleys: Colorado and Mohave deserts; Inyo Co. to Lassen and Modoc cos.; east to New Mexico and north to Washington.

Var. **baileyi** Jepson n. comb. Smaller, branchlets always spinescent; bark dark gray; leaves usually pubescent, 4 to 7 lines long.—Mono and Inyo cos.; southern Nevada.

Refs.—SARCOBATUS VERMICULATUS Torr. in Emory, Mil. Reconn. 150 (1848); Cov. Contrib. U. S. Nat. Herb. 4: 185 (1893); Chesnut and Wilcox, U. S. Dept. Agr. Div. Bot. Bull. 26: 139 (1901). *Batis (?) vermiculata* Hook. Fl. Bor. Am. 2: 128 (1838), type loc. Columbia River, *Douglas*. *Fremontia vermicularis* Torr. & Frem. in Frem. Sec. Rep. 317, pl. 3 (1845). Var. BAILEYI Jepson. *S. baileyi* Cov. Proc. Biol. Soc. Wash. 7: 77 (1892), type loc. Nye Co., Nev., *Vernon Bailey*; Contrib. U. S. Nat. Hb. 4: 184, pl. 20 (1893).

14. SUAEDA Forsk. SEA BLITE.

Fleshy plants of salt marshes or alkaline plains, with alternate subterete linear leaves. Flowers perfect, or perfect and pistillate on the same plant, sessile in the axils of the leafy bracts, minutely bracteolate; calyx with 5 lobes, fleshy, enclosing the utricle and mostly carinate or crested. Stamens 5. Styles 2 or 3, short and rather thick. Seed with a dark shining crustaceous testa and a spiral embryo. About 45 species, all continents. (Name from the Arabic.)

Low shrubs or bushes; calyx not appendaged; stigmas from the concave summit of a short style; lower leaves mostly with an obscure short petiole.
  Branchlets rather densely crowded with leaves and flowers; calyx cleft about half way. 1. *S. californica.*
  Branchlets with smaller less crowded leaves.
    Mostly pubescent or woolly; calyx cleft half way...... 2. *S. suffrutescens.*
    Mostly glabrous and glaucous; calyx parted nearly to base...... 3. *S. moquini.*
Annuals; calyx transversely appendaged; leaves sessile by a rather broad base...... 4. *S. depressa.*

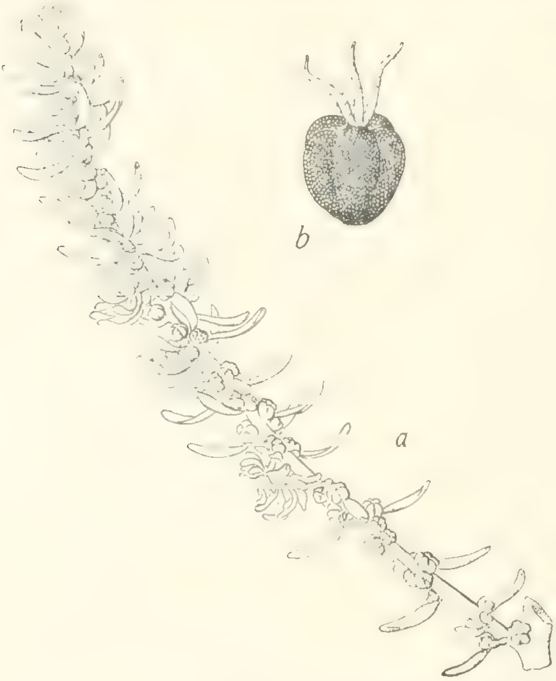

Fig. 91. SUAEDA CALIFORNICA Wats. *a*, flowering branchlet, x 1; *b*, flower with stigmas exposed, x 4.

1. **S. californica** Wats. (Fig. 91. Plants decumbent, 3 to 9 feet across, the stems woody at base, succulent above and bearing ascending or erect leafy

branchlets ½ to 1 foot long; leaves spreading or somewhat recurved, broadly linear, acute, 6 lines long; flowering branches rather thick and crowded with leaves and flowers, the leaves much surpassing the flower clusters; flowers large, 2 lines broad, 1 to 3 in the axils, when 3 the central one perfect, the 2 lateral smaller and pistillate; seed jet-black.

Sandy beaches bordering San Francisco Bay. Sept-Oct. Var. **pubescens** Jepson n. var. Herbage woolly-pubescent. (Planta tomentoso-pubescentia.) Del Mar (San Diego Co.); north along the coast of Southern California as far as Santa Barbara.

Refs.—SUAEDA CALIFORNICA Wats. Proc. Am. Acad. 9: 89 (1874), type loc. salt marshes, San Francisco Bay; Jepson, Fl. W. Mid. Cal. 182 (1901).

2. **S. suffrutescens** Wats. Stem woody, 1½ to 3 feet high, bearing an irregular crown of straggling branches; herbage clothed with a fine pubescence; leaves linear, 2 to 6 (or 12) lines long, the upper little surpassing the flower clusters; calyx cleft a little over half way; clusters mostly 3 to 9-flowered; flowers small, ½ to 1 line broad.

Alkaline valleys: Colorado and Mohave deserts north to Inyo Co.; east to New Mexico. Mexico.

Locs.—Indio, *Parish* 8268; Little Chemehuevis Valley, Colorado River, *Jepson* 5216; Lone Pine, *Jepson* 5122; Tulare plains acc. *Coville*; Livermore Pass, *Jepson*, habitally like the type, but its herbage and flowers glabrous.

Refs.—SUAEDA SUFFRUTESCENS Wats. Proc. Am. Acad. 9: 88 (1874), based primarily on Suaeda fruticosa var. multiflora Torr. Pac. R. Rep. 4^5: 130 (1857), the specimens from west Texas; Cov. Contrib. U. S. Nat. Herb. 4: 184 (1893). *S. torreyana* Jepson, Fl. W. Mid. Cal. 183 (1901).

3. **S. moquini** Greene. ALKALI BLITE. Stems more or less decumbent or irregularly spreading, 2 to 3 feet long; herbage glaucous, glabrous; flowering branches long and slender; leaves linear, 2 to 5 lines long, mostly acute; clusters several-flowered; calyx deeply 5-parted.

Alkaline soil: San Joaquin Valley; Southern California; east to Colorado. Very like the preceding save in habit.

Locs.—Stockton, *Jepson*; San Bernardino Valley, *Parish* 4199.

Refs.—SUAEDA MOQUINI Greene, Pitt. 1: 264 (1889). *Chenopodium moquini* Torr. Pac. R. Rep. 7^3: 18 (1856), based on *Chenopodina linearis* Torr. Bot. Stansbury, 394 (1852), from west side of Great Salt Lake. *Suaeda torreyana* Wats. Proc. Am. Acad. 9: 88 (1874).

4. **S. depressa** Wats. var. **erecta** Wats. Simple or branched at base, erect, strict, ½ to 1½ feet high, glabrous, often glaucous; leaves ¾ to 1¼ inches long, acute; flowering branchlets dense, their leaves short, ovate-acuminate; calyx-lobes somewhat unequal, with a conspicuous horizontal wing on back.

Southern California and north through the desert to Modoc Co.; east to the Rocky Mts.

Refs.—SUAEDA DEPRESSA Wats. Bot. King, 294 (1871). *Salsola depressa* Pursh, Fl. 197 (1814), type loc. plains of the Missouri, *Nuttall*. Var. ERECTA Wats. Proc. Am. Acad. 9: 90 (1874). *Suaeda erecta* Nelson, Coulter's New Man. Rocky Mts. 169 (1909). *Dondia erecta* Nelson, Bot. Gaz. 34: 364 (1902).

15. SALSOLA L.

Bushy-branching herbs with rigid linear or subulate spinescent leaves. Flowers perfect, solitary, sessile and axillary, each subtended by 3 rigid spinescent organs consisting of a bract and 2 bractlets. Calyx 5-parted, its divisions at length horizontally winged on the back. Stamens 5. Ovary depressed; styles 2. Seed horizontal; embryo coiled into a conic spiral; endosperm none.—All continents, about 40 species. (Diminutive of Latin salsus, salty, most of the species of saline habitats.)

1. **S. kali** L. var. **tenuifolia** G. F. W. Mey. RUSSIAN THISTLE. Bushy annual; leaves on the young plant linear, prickle-tipped; branches flowering from

near the base; bracts ovate, shortly acuminate, prickly pointed, the bractlets similar but narrower; calyx divisions converging over mature fruit and forming a sort of beak, the wings irregular in shape and size.

Obnoxious weed, native of Asia, only sparingly established as yet in California. First appeared near Lancaster about 1890, Bakersfield in 1895, Stanislaus Co. in 1903, Antioch in 1900, Salinas Valley in 1910, and Solano Co. in 1911. Now established and troublesome at Ceres. Abundant and highly pernicious in the Dakotas, etc.

Refs. SALSOLA KALI L. Sp. Pl. 222 (1753), type European. Var. TENUIFOLIA G. F. W. Mey. Russian Thistle, U. S. Bur. Pl. Ind. Farmer's Bull. 10 (1893) and Div. Bot. Bull. 15 (1894); Univ. Cal. Agr. Exp. Bull. 107 (1895).

AMARANTHACEAE. AMARANTH FAMILY.

Ours coarse herbs with simple entire leaves. Flowers small, usually greenish, inconspicuous, perfect or unisexual, in ours congested in spikes or clusters. Calyx of 3 to 5 sepals, or sometimes only 1, persistent and more or less scarious. Corolla none. Stamens 5, sometimes fewer. Ovary superior, 1-celled, with 2 or 3 stigmas. Fruit a utricle, indehiscent, bursting irregularly or circumscissile. Embryo curved.—About 500 species, all continents but mostly tropical, none in the cold zones.

Bibliog.—Gray, A., Amblogyne (Proc. Am. Acad. 5: 168-170,—1861). Uline and Bray, Synopsis of N. Am. Amaranthaceae (Bot. Gaz. 19: 267-272, 313-320,—1894; 20: 155-167, 337-344, 449-453,—1895; 21: 348-356,—1896).

Leaves alternate; utricle mostly dehiscent.................................1. AMARANTHUS.
Leaves opposite; utricle indehiscent.......................................2. CLADOTHRIX.

1. AMARANTHUS L. AMARANTH.

Annual weeds with alternate leaves and small green or sometimes purplish glabrous flowers. Flowers bracteate, disposed in axillary or terminal spikes, or in axillary clusters, usually monoecious or polygamous, rarely dioecious, commonly with staminate and pistillate flowers in same cluster. Seed mostly black and shining.—Species 45, mostly tropical but also in the temperate zones of all continents. (Greek a-, not, and maraino, to fade, the spikes of certain species retaining their color in drying.)

Utricle circumscissile, the top falling away as a lid.
  Sepals mostly narrowed upward; flowers monoecious.
    Flowers in dense terminal and axillary spikes; sepals 5, mostly unequal.
      Spikes stout ....1. *A. retroflexus.*
      Spikes slender ....2. *A. hybridus.*
    Flowers in small axillary clusters of short spikes.
      Sepals of same number in staminate and pistillate flowers.
        Sepals 3; plant erect, bushy-branched; utricle very rugose..3. *A. graecizans.*
        Sepals 5 or 4.
          Plant prostrate; utricle a little wrinkled..............4. *A. blitoides.*
          Plant with ascending stems; utricle smooth............5. *A. carneus.*
      Sepals of staminate flower mostly 3, of pistillate flower mostly 1..6. *A. californicus.*
  Sepals 5, mostly dilated upward.
    Flowers monoecious; pistillate sepals fimbriate....................7. *A. fimbriatus.*
    Flowers dioecious; pistillate sepals mostly retuse, mucronate........8. *A. palmeri.*
Utricle fleshy, indehiscent; sepals 2 or 3; prostrate plant.....................9. *A. deflexus.*

1. **A. retroflexus** L. ROUGH PIGWEED. Stoutish, commonly branched from the base, with erect or ascending branches, 1 to 4 feet high; herbage roughish pubescent; leaves rhombic to oblong-ovate, petioled, 1 to 3 inches long; flowers green, densely crowded in spikes; spikes axillary and terminal, erect or slightly spreading, 1 to 4 inches long; bracts lanceolate-subulate, scarious except the green carinate midrib, 1½ to 3 lines long; sepals 5, unequal, oblong-lanceolate, cuspidate, 1 line long or less; utricle wrinkled, surpassed by the sepals.

Very common in orchards, gardens and waste lands. Introduced from tropical America.

Ref.—AMARANTHUS RETROFLEXUS L. Sp. Pl. 991 (1753), the type from Pennsylvania, *Kalm.*

2. **A. hybridus** L. GREEN AMARANTH. Stems erect or ascending, 1 to 4 feet high; herbage glabrous or sparingly pubescent; leaves broadly ovate to ovate-lanceolate, 1 to 4 inches long; spikes slender, bristly, panicled, especially at ends of branches; sepals about ½ as long as the subulate-lanceolate bracts, oblong, acute or acuminate; utricle surpassing the calyx, scarcely wrinkled.

Introduced from tropical America, occurring locally through the state.

Locs.—Yreka, *Butler* 543; Bouldin Island (Zoe, 4: 216); San Bernardino, *Parish* ("as abundant as A. retroflexus"). The var. HYPOCHONDRIACUS Jepson n. comb., with purple-tinged leaves, bracts and flowers, is also introduced in the lower Sacramento River islands (Erythea, 1: 243).

Refs.—AMARANTHUS HYBRIDUS L. Sp. Pl. 990 (1753), the type from Va. *A. chlorostachys* Willd. Hist. Amarant. 34, t. 10, fig. 19 (1798); Parish, Zoe, 1: 125 (1890). Var. HYPOCHONDRIACUS Jepson. *A. hypochondriacus* L. Sp. Pl. 991 (1753), the type from Va.

3. **A. graecizans** L. TUMBLE-WEED. Stems freely and rigidly branching, 1 to 3 or 4 feet high, commonly of bushy outline; herbage light or somewhat yellowish green, glabrous or nearly so; leaves oblong-spatulate or obovate, 4 to 8 lines long; flowers in clusters in short axillary spikes; bracts subulate, 1 to 1½ lines long, much longer than the sepals; sepals 3, oblong, acute or obtuse, thin, shorter than the rugose utricle.

Summer weed; extremely abundant in cultivated fields; naturalized from tropical America. The plant becomes rigid when dead and dry, and when loosened by fall winds is carried across the fields as a tumble-weed, the seeds being thus most effectively dispersed.

Refs.—AMARANTHUS GRAECIZANS L. Sp. Pl. 990 (1753), the type from Va. *A. albus* L. Sp. Pl. ed. 2, 2: 1404 (1763); Jepson, Fl. W. Mid. Cal. 173 (1901).

4. **A. blitoides** Wats. Stems branching, prostrate or spreading and matlike, ½ to 2 feet long; herbage glabrous or nearly so; leaves spatulate to obovate, 4 to 6 or 10 lines long, often white-nerved on the margins and beneath, drawn down to slender petioles; flowers in axillary clusters mostly shorter than the petioles; bracts ovate-lanceolate, little longer than the sepals; sepals 5 or 4, oblong or oblong-lanceolate, acute or cuspidate, slightly shorter, or 1 or 2 equaling or slightly longer, than the utricle; stamens 3; utricle somewhat wrinkled toward the summit.

Washington to Colorado and south to Mexico. Introduced in California.

Locs.—Rialto and Santa Monica, acc. *Abrams* (Fl. Los Ang. 133); Suisun and Niles, acc. *Greene* (Pitt. 2: 105); Yreka, *Butler.*

Var. **crassius** Jepson n. var. Stems 1 to 1½ feet long, these and the branchlets coarsish, whitish, ascending; leaves not at all or scarcely white-veined.—(Caules pedales vel sesquipedales ramulique crassusculi subalbi ascendentes; folia haud albo-venosa.)—Reno, Nev., *Jepson* (type); Modoc Co., *Manning* 242.

Refs.—AMARANTHUS BLITOIDES Wats. Proc. Am. Acad. 12: 273 (1877), type spms. from Nev. (Bot. Gaz. 19: 315).

5. **A. carneus** Greene. Stems ascending, thickish, obscurely angled or grooved, somewhat flexuous, 1 to 1½ feet long; leaves narrowly obovate, acute, bristly tipped, ¾ to 1 inch long, acutely drawn down to a petiole; flowers in axillary clusters of short spikes little exceeding the petioles; axes of the spikes thickish, flexuous; sepals 5, unequal, broadly oblong, acuminate or acute, equaling or the longer ones exceeding the smooth utricle, all more or less cuspidate-tipped; style short and thick, forming a distinct apiculation to the utricle; stigmas 3.

Siskiyou Co. (Yreka, *Butler* 1067). Idaho.

Refs.—AMARANTHUS CARNEUS Greene, Pitt. 2: 105 (1890), type loc. Beaver Cañon, Idaho, *Greene.*

6. **A. californicus** Wats. Stems prostrate, 4 to 12 inches long, stoutish and rather fleshy, with numerous short branchlets; leaves obovate to oblong, mostly obtuse, prominently mucronate, the veins and margins white, 2 to 5 lines long, the petiole ½ to as long; flowers green or reddish, in many small axillary clusters; sepals in staminate flower 3 (or 2), membranous, oblong-ovate, mucronate or erosulate; stamens 3 (or 2 or 1); sepals in pistillate flower 1 (or 2 or 3); utricle smooth, bursting irregularly and releasing a red seed.

Moist soils, often in beds of dried-up pools or lakes; California to southern Oregon and western Nevada. Sept.-Oct.

Locs.—Yreka, *Butler* 133; Searsville, San Mateo Co., *C. F. Baker* 1855; Palomar, *McClatchie.*

Refs.—AMARANTHUS CALIFORNICUS Wats. Bot. Cal. 2: 42 (1880). *Mengea californica* Moq. in DC. Prodr. 13^2: 270 (1849), type loc. Monterey, *Hartweg* 1930; "Caulis * * * erectus"; otherwise the spms. above cited agree notably with description of the type.

A. ALBOMARGINATUS Uline & Bray, Bot. Gaz. 19: 318 (1894), type loc. Monterey Co., *Palmer* 456 in 1876. Stems white; leaves elliptical, very small (1 to 2 lines long), conspicuously white-margined; flowers crowded in the dense foliage; sepals 2 or 3, minute, scale-like.—Not known to us, but apparently the plant we here take to be A. californicus.

7. **A. fimbriatus** Wats. Stems several from the base, 1 to 2 feet high, simple or sparingly branched; herbage glabrous, purplish, especially the inflorescence; leaves linear, narrowed below into a short petiole, 1 to 2 inches long; flowers in rather loose clusters; clusters scattered or mostly approximate and forming a long terminal spike; bracts ovate, acute, scarious-bordered, shorter than the calyx; sepals of staminate flowers oblong, obtuse, those of the pistillate flowers broadly fan-shaped with a narrow thickened base and fimbriate margin, 1 line long; "stamens 2 or 3"; stigmas 3.

Mohave and Colorado deserts, east to Utah and Texas, south into Mexico.

Locs.—Lanfair, *Maye Tennent;* Julian, *Cleveland.*

Refs.—AMARANTHUS FIMBRIATUS Wats. Bot. Cal. 2: 42 (1880). *Amblogyne fimbriata* Gray, Proc. Am. Acad. 5: 168 (1861). *Sarratia berlandieri* var. *fimbriata* Torr. Bot. Mex. Bound. 179 (1859), type loc. Gila River, *Schott.*

8. **A. palmeri** Wats. Stems stout, erect, 2 to 4 feet high, glabrous or pubescent; leaves broadly ovate, acute or acuminate, broadly cuneate at base, 1 to 4 inches long, on petioles 1 to 2 times as long; flowers dioecious, in dense elongated spikes leafy at base; bracts solitary, those of the pistillate spikes subulate, spreading, rigid, awn-tipped, narrowly scarious-margined at base, 2 to 3 times as long as the flowers; calyx ¾ to 1½ lines long, falling with the fruit, unequal, obscurely cordate at base; sepals of staminate flower oblong-ovate and acute, or oblong-lanceolate and acuminate; sepals of pistillate flower obovate, retuse or truncate, usually mucronate or setaceously apiculate; stigmas 2; utricle rugose at summit.

Colorado Desert; east to Texas and south into Mexico.

Locs.—Holtville, *Parish* 8269; Chemehuevis Valley, Colorado River, *Jepson* 5209; Ft. Yuma, *Brandegee;* Salton Creek, *Brandegee;* Cameron Lake, *Brandegee.* Abundant in southern Arizona where, cut and stacked by the Mexican population as a winter feed for horses, it yields nearly 3 tons per acre (Bur. Pl. Ind. Bull. 67: 58).

Ref.—AMARANTHUS PALMERI Wats. Proc. Am. Acad. 12: 274 (1877), type loc. Larkin's Sta., San Diego Co., *Palmer* 323.

9. **A. deflexus** L. Stems slender, prostrate, a little succulent, 1 to 1½ feet long; leaves rhombic-ovate; flowers polygamous, in short spikes clustered in the axils, or disposed in dense terminal spikes 1 inch long or more; sepals 2 or 3, oblong, surpassing the bracts; utricle 3 to 5-ribbed, surpassing the sepals, indehiscent.

Introduced from southern Europe; naturalized along streets and in gardens; towns about San Francisco Bay.

Ref.—AMARANTHUS DEFLEXUS L. Mant. 2: 295 (1771), type European.

2. CLADOTHRIX Nutt.

Stellate-pubescent annuals or woody-based perennials with opposite leaves. Flowers axillary, solitary or in small glomerules, perfect, subtended by 3 small bracts and by foliaceous involucral bracts. Sepals 5, equal, thin, pubescent. Stamens 5, arising from the margin of a short cup-shaped hypogynous disk, with 5 short teeth alternating with the filaments. Achene subglobose, indehiscent.—Species 3, southern United States and Mexico. (Greek klados, branch, and thrix, hair, in reference to the stellate covering.)

1. **C. oblongifolia** Wats. White-woolly perennial; stems widely branching, forming low broad mound-like plants 9 to 15 inches high and 1½ to 3 feet broad; leaves roundish ovate, obtuse, 3 to 10 lines long, shortly petioled; involucral bracts united and forming definite involucres; involucres paniculately disposed, subsessile or shortly peduncled, their tubes oblong-turbinate, 1 to 1½ lines long, their lobes 3, foliaceous, round-ovate, 1 to 2 lines long; sepals ovate-lanceolate, 1 line long.

Sandy washes; Colorado Desert and eastern Mohave, north into Inyo Co. Arizona, southern Nevada.

Locs. Milpitas, Colorado River, *Jepson* 5283; Salton, *Parish*; Bagdad, *T. Brandegee*; Death Valley, acc. *Coville*. Ash Mdws., Nev., *Purpus* 6025.

Refs.—CLADOTHRIX OBLONGIFOLIA Wats. Proc. Am. Acad. 17: 376 (1882), type spms. from the Colorado River (Chimney Peak, *Newberry*, and Yuma, *Pringle*) and the Mohave Desert, Warm Sprs., *S. B. & W. F. Parish* 1346; Cov. Contrib. U. S. Nat. Herb. 4: 179 (1893). *C. cryptantha* Wats. Proc. Am. Acad. 26: 125 (1891), based on spms. by *Parry* (e. Colorado Desert) and by *Orcutt* 2186 (Carrizo Creek, San Diego Co.); Parish, Zoe, 5: 113 (1901). *C. lanuginosa* Wats. Bot. Cal. 2: 43 (1880), not Nutt. With each flower-cluster set in an involucral cup, C. oblongifolia is sharply separated from C. lanuginosa Nutt., which has solitary flowers and its involucral bracts quite distinct. The latter species occurs in Arizona and may yet be found in southeastern California.

Alternanthera achyrantha R. Br. Prodr. 1: 417 (1810). Prostrate annual with opposite leaves; leaves broadly ovate or obovate, shortly acute or mucronate, 5 to 11 lines long, cuneately narrowed at base into a petiole; flowers perfect, in short white spikes; spikes dense, mostly axillary, solitary or clustered, 3 to 6 lines long; sepals 5, lanceolate, unequal, 2 more carinate-concave, all woolly on the back with barb-tipped hairs; stamens 5, with 5 alternating sterile filaments, all united at base into a cup-like disk; achene flattened, indehiscent.—Native of Mexico, locally introduced at Los Angeles (Erythea, 1: 99).

NYCTAGINACEAE. FOUR-O'CLOCK FAMILY.

Ours more or less succulent herbs or low shrubs with opposite entire leaves and commonly swollen joints. Flowers perfect, regular, subtended by bracts which often form a calyx-like involucre. Bracts or involucres often colored. Calyx plicate in the bud, tubular, colored like a corolla and very delicate, 4 or 5-lobed, the lower part of its tube circumscissile and leaving a persistent base which is closely constricted over but not attached to the superior ovary. Corolla none. Stamens in ours 3 to 5 (or 7), mostly unequal, hypogynous (or perigynous in Abronia). Ovary 1-celled, 1-ovuled; style and stigma 1. Fruit an achene, closely invested by the base of the calyx-tube, which becomes very much hardened and is often striate, ridged, or winged. Embryo mostly coiled, with mealy endosperm; cotyledons 2, or only 1 in Abronia by reduction.—Genera 20 and species about 200; all continents but mainly American.

Bibliog.—Gray, A., Some new Gen. and Sp. of Nyctaginaceae, prin. coll. in Tex. and New Mex. (Am. Jour. Sci. ser. 2, 15: 259-263, 319-324,—1853). Rydberg, P. A., Nyctaginaceae of Rocky Mt. Reg. (Bull. Torr. Club, 29, 680-693,—1902). Jones, M. E., Nyctaginaceae of the Great Plateau (Contrib. 10: 34-54,—1902). Standley, P. C., Allioniaceae of the United States

(Contrib. U. S. Nat. Herb. 12: 303-389,—1909); Allioniaceae of Mexico and Central America (l. c. 13: 377-430,—1911).

Flowers without an involucre, each pedicel bearing or subtended by 1 to 3 small bracts.
  Calyx campanulate or funnelform, mostly reddish or purplish.
    Fruit 5-angled or 5-ribbed..1. Boerhaavia.
    Fruit globose, smooth..2. Hermidium.
  Calyx salver-shaped with very much elongated tube, white..............3. Acleisanthes.
Flowers subtended by an involucre.
  Involucral bracts distinct or nearly so; fruit usually winged.
    Bracts 5 or more, wholly distinct; fruit without glands................4. Abronia.
    Bracts 3, distinct nearly to base; fruit with 2 rows of glands.......5. Wedeliella.
  Involucre composed of more or less united bracts; fruit not winged.
    Fruit 5-ribbed; involucre enlarged in fruit..........................6. Allionia.
    Fruit mostly smooth; involucre unchanged in fruit...................7. Mirabilis.

1. BOERHAAVIA L.

Slender herbs with glandular rings about the internodes. Blades of the opposite leaves unequal. Bracts minute, 1 to 3 to each flower. Flowers small, on jointed pedicels. Calyx campanulate or funnelform, 5-lobed. Stamens 1 to 5; filaments slender, united at base. Stigma shield-shaped. Fruit club-shaped to obpyramidal, 3 to 5 (or 10) -ribbed, or -angled, or narrowly winged. —Species 50, all continents. (H. Boerhaave, 1668-1738, famous Dutch physician and botanist, professor at Leiden.)

Calyx campanulate; fruit 5-ribbed.
  Annual; fruit glabrous..1. *B. intermedia.*
  Perennial; fruit glandular-viscid.......................................2. *B. hirsuta.*
Calyx funnelform; fruit obscurely 10-ribbed...............................3. *B. annulata.*

1. **B. intermedia** Jones. Low, spreading or ascending, the stems almost filiform-slender, ¾ to 1¼ feet long; leaves elliptic to lanceolate, obtuse or acute; peduncles bearing 2 to 5 umbellate or subcapitate flowers; calyx 1 line long; fruit cuneate or short-clavate, 1 to 1½ lines long.

Southwestern Colorado Desert (*Orcutt* 2090 acc. *Standley*), east to Texas and south into Mexico.

Refs.—Boerhaavia intermedia Jones, Contrib. 10: 41 (1902), type loc. El Paso, Tex., *Jones* 4173; Stand. Contrib. U. S. Nat. Herb. 12: 382 (1909).

2. **B. hirsuta** Willd. Stem branching, 2 or 3 feet long, parts or some of the internodes and petioles sparsely hirsute-glandular; leaves round-ovate, mostly obtuse or some acutish, rounded at base, ½ to 2 inches long; flowers nearly sessile in small clusters terminating slender peduncles, the peduncles more or less divaricate in a loose panicle; calyx red, 1 line long; fruit 1 to 2 lines long, 5-ribbed.

San Jacinto Valley and Coyote Cañon (Southern California), east to Arizona and Mexico.

Refs.—Boerhaavia hirsuta Willd. Phyt. 1 (1794); Stand. Contrib. U. S. Nat. Herb. 12: 382 (1909).

3. **B. annulata** Cov. Perennial; stem stout, erect from an ascending base, glabrous, glaucous, 1 to 3 feet high, the middle of each internode usually with a reddish mucilaginous ring; leaves ovate-oblong, cordate or rounded at base, obtusish at apex, thick, rigid, fleshy, entire or sometimes "lacerate," 1 to 2 inches long, hirsute; petiole nearly as long as blade; flowers 3 to 4 lines long, in small clusters terminating the branches; stamens 3, and with the style, conspicuously exserted; fruit turbinate, glabrous, obscurely 10-ribbed, 2½ lines long.

Death Valley region.

Refs.—Boerhaavia annulata Cov. Contrib. U. S. Nat. Herb. 4: 177, pl. 18 (1893), type loc. Furnace Creek Cañon, Funeral Mts., *Coville* 577. *Anulocaulis annulatus* Stand. Contrib. U. S. Nat. Herb. 12: 375 (1909).

2. HERMIDIUM Wats.

Perennial glabrous herbs with thick fleshy leaves. Flowers in head-like clusters on the ends of terminal or axillary peduncles; clusters 6 to 8-flowered, each flower subtended by a large ovate leathery bract, the short pedicels adnate to the midveins of the bract. Calyx campanulate-funnelform, light purple, slightly lobed. Stamens 5 to 7, these and the style about as long as the calyx. Fruit nearly globose, smooth, glabrous.—Monotypic. (Diminutive of the Greek Hermes, perhaps a fancied resemblance between the pediceled flower and a little statue of that god.)

1. **H. alipes** Wats. Stems several from a woody caudex, stout, ascending, simple or slightly branched, 5 to 12 inches high; leaves round to oblong-ovate, obtuse or subacute, subcordate at base, 1 to 2 inches long, very shortly petioled; bracts occasionally slightly united.

Panamint and White mountains, north to north-central Nevada, thence east to Utah.

Refs.—HERMIDIUM ALIPES Wats. Bot. King, 286, pl. 32 (1871), type loc. Humboldt Valley, Nev., *Watson.*

3. ACLEISANTHES Gray.

Perennial herbs or low shrubs. Flowers axillary or terminal, each subtended by 1 to 3 small narrow bracts. Calyx white, with a very much elongated slender tube and spreading but very small 5-lobed limb. Stamens 2 to 5, unequal, the slender filaments united at the base. Fruit narrowly ellipsoidal, 5-angled or 5-ribbed.—Southwestern United States and Mexico, 7 species. (Greek a-, privative, cleis, something which closes, and anthos, flower, the flower not enclosed by the involucre.)

1. **A. longiflora** Gray. YERBA DE LA RABIA. Stems slender, scabrous puberulent, 6 to 10 inches long; leaves triangular-lanceolate, acute, broadly cuneate at base, ½ to 1 inch long, shortly petioled; calyx-tube 4 to 4½ inches long, its lobes 2 or 3 lines long; stamens exserted.

Marie Mts., eastern Riverside Co., *Schellenger.* East to Texas and south into Mexico.

Refs.—ACLEISANTHES LONGIFLORA Gray, Am. Jour. Sci. ser. 2, 15: 261 (1853), type loc. Valley of the Limpio, Texas, *Wright* 599; Torr. Bot. Mex. Bound. 170, pl. 46 (1859).

4. ABRONIA Juss.

Herbs with viscid herbage. Leaves of the opposite pairs more or less unequal. Peduncles axillary or terminal, bearing a many-flowered head subtended by 5 to 15 distinct involucral bracts. Flowers showy. Calyx salverform. Stamens commonly 5, unequal, included in the tube and inserted upon it. Style included. Persistent base of calyx 3 to 5-winged, more or less reticulate, enclosing a cylindrical achene.—Species about 25, western North America. (Greek abros, graceful.)

1. Caulescent plants.

- Fruits with 2 to 5 conspicuous wings.
  - Fruits very large and with very thick wings; seacoast.
    - Flowers yellow ....1. *A. latifolia.*
    - Flowers deep dark red..2. *A. maritima.*
  - Fruits smaller and with thinner wings; flowers red, pink or white.
    - Herbage glandular or glandular-puberulent; seacoast.
      - Wings mostly 5, broadened upward, truncate above or tapering to the beak...... 3. *A. umbellata.*
      - Wings mostly 3, wider, produced above into a rounded lobe which surpasses the body ....4. *A. alba.*
    - Herbage villous, usually glandular; mostly of the interior.
      - Wings usually 5, often unequal..5. *A. villosa.*
      - Wings only 2..6. *A. pogonantha.*

Fruits narrowly winged or wingless.
  Wings 5, narrow, sometimes ridge-like....................................7. *A. turbinata.*
  Wings or ridges 2 or none..8. *A. exalata.*

2. *Acaulescent or nearly so; high montane.*

Prostrate, forming thick mats; clusters 2 or 3 flowered.......................9. *A. alpina.*
Erect, scapose; clusters about 15-flowered....................................10. *A. nana.*

1. **A. latifolia** Esch. Yellow Sand-Verbena. Stems stout, 1 to 2 feet long, prostrate, only the leaves and flowering peduncles ascending or erect; herbage very succulent, glandular-puberulent; leaves orbicular and broader than long to broadly ovate, truncate or reniform at base, ½ to 1½ inches long; peduncles usually exceeding the leaves; bracts 5, broadly ovate, acute, 2 to 3 lines long; flowers somewhat fragrant, yellow, 6 lines long; fruit broadly turbinate, 4 to 7 lines long, its 5 wings more or less unequal, broadened from the base upward, then sloping abruptly to the short beak or truncate, or the wings sometimes much reduced; taproots cylindric, fleshy, ½ to 2 inches thick, 1 to 1½ feet long, often (when large) with rope-like branches several feet long.

Common along the seashore from Santa Barbara Co. to Monterey and northward to Vancouver Island. May-Nov.

Ref.—Abronia latifolia Esch. Mem. Acad. Petersb. 10: 281 (1826), type from California (Linnaea, 3: litt. ber. 147).

2. **A. maritima** Nutt. Stems prostrate, 1 to 2 feet long; herbage glandular-puberulent; leaves thick, round-ovate, with regular flowing outline, ½ to 1¾ inches long; flowers deep dark red; bracts thick, long oblong, acute, 4 to 5 lines long; fruit large (5 to 7 lines long, 6 to 10 lines broad), its 5 wings strongly broadened upward, often somewhat produced above the body and equaling or exceeding the short beak, or sometimes one or more much reduced.

Seashore, San Luis Obispo Co. to San Diego. Lower California, Mexico.

Locs.—Avila, San Luis Obispo Bay, *Summers;* San Clemente Isl., *T. Brandegee;* Del Mar, *T. Brandegee;* San Diego, *Jepson* 1596; Coronado, *Berg.* The large globose clusters of fruit suggest vaguely the head of Medusa. The variations in fruit and pubescence would, to a certain degree, afford basis for segregation of forms similar to those of A. umbellata.

Ref.—Abronia maritima Nutt.; Wats. Bot. Cal. 2: 4 (1880), type loc. San Pedro, *Nuttall* (ex. label of type in Gray Herb.).

3. **A. umbellata** Lam. Common Sand-Verbena. Stems slender, prostrate, viscid, 1 to 3 feet long; leaves nearly glabrous, roundish or ovate to narrowly oblong, the margin often somewhat sinuate, 1 to 1½ inches long; heads 10 to 15-flowered, on peduncles 2 to 6 inches long; involucral bracts narrowly lanceolate, 2 or 3 lines long; calyx rose-purple, 6 to 8 lines long; fruit 4 to 5 lines long, often as broad; wings mostly 5, rather thin but firm, widened upward and broadest above, at apex truncate or sloping to the beak, usually shorter than the beak, or the wings sometimes reduced and the fruit narrow and spindle-like.

Common, Californian seacoast from Los Angeles Co. to Monterey, San Francisco Bay, Humboldt Co. and north to Washington.

Refs.—Abronia umbellata Lam. Tab. Encycl. 1: 469, pl. 105 (1791), the type spm. cult. at Paris from seed coll. at Monterey by Collignon of the La Perouse Exped. (Jussieu, Gen. 449); Jepson, Erythea, 1: 189 (1893). Lamarck's illustration shows a cluster of somewhat spindle-shaped 5-winged fruits. This is the earliest described new species from California. *A. insularis* Stand. Contrib. U. S. Nat. Herb. 12: 311, pl. 28 (1909), type loc. San Clemente Island, *Trask;* differs from A. umbellata in its glabrous stems, elongated internodes and thick coriaceous fruit wings, ex. char.; not seen by us.

Plants are sometimes found with very narrowly winged or ridged fruits, the wing broadest near the middle and tapering to both base and apex (Seaside, Monterey Co., *K. Brandegee*), or again with small flowers about 5 lines long (Eureka, *Tracy* 2550). Plants enjoying both the above characters answer to *A. breviflora* Stand. Contrib. U. S. Nat. Herb. 12: 312, pl. 30

(1909), type loc. Mendocino, *Brown* 833. *A. neurophylla* Stand. l. c. 314, pl. 32, type loc. San Nicolas Island, *Trask* 23, is a larger, stouter plant than A. umbellata with thicker fleshy leaves and thicker bracts, ex. char.; fruit unknown.

4. **A. alba** Eastw. Similar to A. umbellata; leaves orbicular to elliptical or oblong, often wavy-sinuate; bracts narrowly ovate, acuminate; flowers white; fruit glabrous or nearly so, its body smaller and whiter than in A. umbellata, its wings thin but firm, broader below than in that species and somewhat prolonged above the body as rounded lobes.

San Nicolas Island. On the mainland represented by varieties which are scarcely separable from the species; the first variety evidently passes into A. umbellata on the Santa Barbara coast.

Var. **platyphylla** Jepson n. comb. Leaves mostly rather broad, wavy-sinuate; flowers pinkish or reddish; fruit wings chartaceous.—Seacoast, San Diego to San Luis Obispo Co., and perhaps north to Monterey. Var. **variabilis** Jepson n. comb. Internodes elongated; leaves few, small, irregularly rhomboidal to oblong; flowers as in preceding; wings membranous.—San Diego to San Luis Obispo Co.

Refs.—ABRONIA ALBA Eastw. Proc. Cal. Acad. ser. 3, 1: 97 (1898), type loc. San Nicolas Island, *Blanche Trask*. Var. PLATYPHYLLA Jepson. *A. platyphylla* Stand. Contrib. U. S. Nat. Herb. 12: 314, pl. 33 (1909), type loc. Del Mar, San Diego Co., *T. Brandegee*. Var. VARIABILIS Jepson. *A. variabilis* Stand. l. c. 314, pl. 31, fig. 1, type loc. Redondo, *Braunton* 258. *A. minor* Stand. l. c. 313, pl. 29, fig. 2, type loc. McGinnis, n. San Luis Obispo Co., *Palmer* 521; wings thin and soft, those of the outer fruits very narrow, widest in the middle and narrowed above and below; not seen by us, but ex. char., seems near var. variabilis.

5. **A. villosa** Wats. Stems trailing, ½ to 1 foot long; herbage glandular-villous or the blades subglabrous; leaves ovate to elliptic, a little wavy-margined, ½ to 1¼ inches long; bracts narrowly lanceolate, acuminate, 3 to 5 lines long, scarious; flowers rose-purple, 5 to 8 lines long; fruit 3 lines long and 4 or 5 lines broad, 5-winged, the thin wings obliquely widened upward and forming broad diverging lobes more or less auriculately produced beyond the body; body reticulate-honeycombed; beak slender, often prominent.

Southern California, east to Arizona and Utah.

Locs.—San Luis Obispo, acc. *Standley;* Ash Hill, Mohave Desert, *Hall* 6101; Barstow, *K. Brandegee* (wings submembranous); Kramer, *K. Brandegee* (the specimens show wingless fruits on same plants with the usual winged fruits); San Felipe, Colorado Desert, *Stephens;* Anaheim, acc. *Standley;* Carrizo Creek, *T. Brandegee.*

Var. **aurita** Jepson n. comb. Body less reticulate or scarcely at all so; flowers 8 to 13 lines long; does not seem to differ essentially otherwise.—San Jacinto, *Jepson* 1245; San Felipe, *T. Brandegee;* Calexico, acc. *Parish* in herb.

Refs.—ABRONIA VILLOSA Wats. Am. Nat. 7: 302 (1873), type from Ariz., *Wheeler.* Var. AURITA Jepson. *A. aurita* Abrams, Bull. Torr. Club, 32: 537 (1905), type loc. Palm Sprs., *Parish* 4138. *A. pinetorum* Abrams, Bull. Torr. Club, 32: 537 (1905), type loc. Thomas Valley, San Jacinto Mts., *Hall* 2166; leaves smaller; fruit pink; otherwise essentially like var. aurita.

6. **A. pogonantha** Heimerl. Stems trailing, 10 to 12 inches long; herbage glandular short-villous or the blades nearly glabrous; leaves ovate or broadly oblong to oblong-lanceolate, 1 to 2 inches long; bracts ovate, acute or acuminate, 3 lines long; calyx pale or lavender white, or purple, 8 lines long; fruit commonly 2-winged, rarely with a third smaller wing, round-obcordate with a somewhat squarish notch at summit, 2 to 3 lines long and as broad, the body and wings reticulate.

Mohave Desert, north to the San Carlos Range and to Inyo Co.

Locs.—San Carlos Creek, *Jepson* 2738; Kramer, *Jepson* 5332; Lancaster, *K. Brandegee;* Antelope Valley, *Davy* 2214; Olancha, *Hall & Chandler* 7348.

Refs.—ABRONIA POGONANTHA Heimerl, Engler, Bot. Jahrb. 11: 87, pl. 2, fig. 4 (1889), type loc. Hesperia, *Parish* 1345. *A. angulata* Jones, Contrib. 8: 39 (1898), type loc. Darwin Mesa, Argus Mts., *Jones.*

7. **A. turbinata** Torr. Annual; stems ascending or suberect, puberulent; leaves round-ovate to elliptical, glabrous, bright green, ½ to 1½ inches long;

bracts lanceolate, acute; flowers whitish or pinkish, 8 or 9 lines long; fruit 2½ to 3 lines long, narrowly obpyramidal, its much wrinkled wings gradually narrowed upwards and truncate at summit.

Death Valley region; north into Nevada and Oregon, east to New Mexico.

Locs.—Deep Spring Valley, *Purpus* 5822; Bishop, *Heller* 8346.

Ref.—ABRONIA TURBINATA Torr.; Wats. Bot. King. 285, pl. 31 (1871), type loc. Hot Spring Butte, Humboldt Co., Nev., *Watson*.

8. **A. exalata** Stand. Very similar to A. turbinata and perhaps only a mere form of it; leaves ovate to roundish, truncate at base, ½ to 1 inch long; flowers 5 lines long; fruit 2 lines long, with mostly 2 ridges or narrow wings on one side, these ridges incurved and forming a sort of half-closed concavity; beak prominent for the size of the fruit.

Southern Sierra Nevada, eastward to Nevada.

Locs.—Kern River, acc. *Standley;* Owens Lake, *Jepson* 5126.

Ref.—ABRONIA EXALATA Stand. Contrib. U. S. Nat. Herb. 12: 318, pl. 36 (1909), type loc. Keeler, Inyo Co., *Coville & Funston* 845.

9. **A. alpina** Brandegee. Stems from perennial roots shortly branched, forming dense mats, 3 to 6 inches across; herbage glandular but blades mostly glabrous; leaves orbicular to round-ovate, 2 to 3 lines long, the petioles 1 to 3 times as long; involucres 3 to 5-flowered, on peduncles 2 to 3 lines long; flowers pink or white, 5 or 6 lines long, the limb 3 to 4 lines broad; fruit 1½ to 2 lines long, narrowed to both ends, 5-angled but not winged.

High sandy meadows, 8000 to 9000 feet, southern Sierra Nevada from near Mt. Whitney to Olancha Peak.

Locs.—Ramshaw Mdws., near Kern Peak, *Mary Haskell, Jepson* 4953; meadows about Templeton Mt., *Jepson* 4971. Plants very handsome, flowering profusely and forming a beautiful lavender-pink fringe on the white sands bordering the meadows in this region.

Ref.—ABRONIA ALPINA Brandegee, Bot. Gaz. 27: 456 (1899), type locs. Monatchee Mdws. and at Mt. Templeton, *Purpus* 1877, 1497.

10. **A. nana** Wats. Peduncles 3 or 4 inches high, erect, scape-like, arising from a dense tuft of leaves crowning the shortly-branched caudex of a perennial root; herbage glandular-puberulent or the blades nearly glabrous; leaves ovate to oblong, 4 to 10 lines long, mostly long-petioled; involucre about 13 to 20-flowered; bracts ovate to oblong-lanceolate; flowers 6 lines long; fruit obcordate in outline, the wings membranous.

Desert ranges, 6000 to 9000 feet, Mohave Desert east to Arizona and Utah.

Loc.—Rose Mine, San Bernardino Mts., *Parish* 3046.

Refs.—ABRONIA NANA Wats. Proc. Am. Acad. 14: 294 (1879), type loc. Beaver City, Utah, *Palmer* 404½. *A. covillei* Heimerl, Smithson. Misc. Coll. 52: 197 (1908), type loc. Inyo Mts., *Coville & Funston* 1782; Stand. Contrib. U. S. Nat. Herb. 12: 316, pl. 34 (1909); "differs from A. nana in its very minute pubescence which is not glandular and its ovate leaves, in having lanceolate bracts which are not scarious and are smaller than in that species, and in its smaller flowers"; fruit unknown.

5. WEDELIELLA Cockerell.

Prostrate herbs, ours perennial. Leaves of the opposite pairs very unequal. Flowers reddish or white, 3 in each involucre. Involucres 3-flowered, solitary on axillary peduncles, deeply divided into 3 sepal-like bracts. Calyx with a short oblique tube and 4 unequal lobes. Fruit leathery, smooth and somewhat carinate on the convex side, the opposite side furnished with 2 low parallel thin ridges, each bearing a row of stipitate glands and covered by the inflexed toothed margins of the lateral wings.—One or two variable species. (Diminutive of Wedelia, Loefling's name for this genus, which is doubtless derived from a personal name.)

1. **W. incarnata** Cockerell. Stems slender, 1 to 2½ feet long; herbage pubescent; leaves ovate, acute, the veins prominent on the under side, ½ to

1⅜ inches long, shortly petioled; flowers white to rose-color, 3 to 4 lines long; fruit 2 lines long, its inflexed margin 2 or 3-toothed.

Cañons on the western border of the Colorado Desert. East to Utah and Texas, south to Chile.

Var. VILLOSA Cockerell. Stems villous pubescent.—Providence Mts., *T. Brandegee.* Var. NUDATA Cockerell. Upper internodes long and upper leaves somewhat reduced.—Palm Cañon, *Hall* 1872; Coachella, *Hall* 5808; Chuckawalla Wash, *Schellenger* 101; Ash Hill, Mohave Desert, *Hall* 6102.

Refs.—WEDELIELLA INCARNATA Cockerell, Torreya, 9: 167 (1909). *Wedelia incarnata* Kuntze, Rev. Gen. Pl. 533 (1891). *Allionia incarnata* L. Syst. ed. 10, 890 (1759), type loc. Cumana, Venezuela. Var. VILLOSA Cockerell, l. c. *Wedelia incarnata* subsp. *villosa* Stand. Contrib. U. S. Nat. Herb. 12: 333 (1909), type from Ariz., *Pringle.* Var. NUDATA Cockerell, l. c. *Wedelia incarnata* subsp. *nudata* Stand. l. c., 334, type loc. Coyote Cañon, *Hall* 1872.

6. **ALLIONIA** Loefl. UMBRELLA-WORT.

Perennial herbs. Leaves slightly fleshy. Involucres 5-lobed, in fruit enlarged and membranous or reticulate-veined, 1 to 5-flowered. Flowers red to purplish or white. Calyx campanulate or funnelform. Stamens 3 to 5, unequal; filaments united at base. Fruit clavate, 5-angled or 5-ribbed.—Species about 60, southwestern United States to Chile. (Chas. Allioni, 1725-1804, Italian botanist.)

1. **A. brandegei** Stand. Stems erect or spreading, 4 to 7 inches high, from a thick woody root; herbage viscid pubescent or nearly glabrous; leaves broadly lanceolate, ¾ to 1½ inches long, shortly petioled; involucres one to an axil, shortly peduncled; flowers unknown; fruit with 4 or 5 low more or less tuberculate ribs, 3 lines long, pubescent.

Eastern Mohave Desert to southern Nevada.

Ref.—ALLIONIA BRANDEGEI Stand. Contrib. U. S. Nat. Herb. 12: 346 (1909), type loc. Providence Mts., *T. Brandegee.*

7. **MIRABILIS** L.

Perennial herbs. Flowers 1 to several in a 5-lobed calyx-like involucre. Involucres mostly campanulate, axillary or terminal, borne on short peduncles and in clusters or solitary. Calyx campanulate to funnelform, white or red. Stamens usually 5. Fruit narrowly ellipsoidal to globose, not angled or ribbed, or rarely so, mostly smooth, glabrous. (Latin mirabilis, wonderful.)

Flowers several in an involucre; calyx funnelform; stamens united at base.—Subgenus QUAMOCLIDION.
Fruit 5-angled, tuberculate..1. *M. greenei.*
Fruit not angled, 10-striate, not tuberculate..........................2. *M. froebellii.*
Flowers solitary in each involucre; calyx campanulate; stamens distinct; fruit smooth.—Subgenus HESPERONIA.
Involucral lobes linear or lanceolate, 1 to 2 times as long as tube........3. *M. tenuiloba.*
Involucral lobes short-ovate to short-lanceolate, ½ to as long as tube...4. *M. californica.*

1. **M. greenei** Wats. Stems several from a perennial root, once or twice forked, 1 to 2 feet high; herbage minutely glandular-puberulent; leaves ovate, acute, 1½ to 2½ inches long, shortly petioled; involucres 7 to 10-flowered, 1 to 1¼ inches high, campanulate, shortly lobed, the lobes broad, acute at apex; calyx greenish purple, tubular-funnelform, 1½ inches long; fruit "5-angled," longitudinally ridged, more or less tuberculate.

Northern California: Tehama Co. north to Siskiyou Co. May.

Locs.—Hornbrook, *Howell* 1386; Yreka, *Butler* 774; Shasta Valley, *Butler* 1334; Cold Fork, Yollo Bolly foothills, *Jepson.*

Refs.—MIRABILIS GREENEI Wats. Proc. Am. Acad. 12: 253 (1877), type loc. Yreka, *Greene. Quamoclidion greenei* Stand. Contrib. U. S. Nat. Herb. 12: 358 (1909).

2. **M. froebellii** Greene. Stems stout, many from a perennial root, forking and diffusely spreading and so forming circular plants 1 to 3 feet broad; herbage glandular-pubescent; leaves broadly ovate, 1¼ to 4 inches long, often broader than long, subcordate at base, acutish or obtuse at apex; petioles

short; involucre 5 or 6-flowered, campanulate, 8 to 10 lines long, cleft nearly half way into acute lobes; calyx bright or pale purple, funnelform, 1½ to 1¾ inches long, the limb 1 to 1½ inches across; fruit light brown, marked by 10 vertical lines of a darker color, not tuberculate.

Kern Co. and Argus Mts. south to San Diego Co. May-June. Very handsome when in full flower in the desert washes, single plants often forming masses of rose-color the size of a wagonwheel.

Locs.—Cottonwood Creek, Inyo Co., *Purpus* 3024; New York Mts., *Jepson* 5446; Bakersfield, *Davy* 1889 ("opens at 6 pm"); Caliente, *K. Brandegee;* Antelope Valley, *Hall* 6259; Palm Cañon, *Jepson* 1376. The following are glabrous or nearly so (var. **glabratum** Jepson n. comb.): Vandeventer Flat, San Jacinto Mts., *Hall* 2162; San Felipe, *Brandegee.*

Refs.—MIRABILIS FROEBELLII Greene, Bull. Cal. Acad. 1: 124 (1885). *Oxybaphus froebellii* Behr, Proc. Cal. Acad. 1: 69 (1855), type loc. Warner's Ranch, San Diego Co., *Froebel. Mirabilis multiflora* var. *pubescens* Wats. Bot. Cal. 2: 2 (1880). *Quamoclidion froebellii* Stand. Contrib. U. S. Nat. Herb. 12: 359 (1909). Var. GLABRATUM Jepson. *Q. froebellii* subsp. *glabratum* Stand. l. c., 360, type loc. Providence Mts., *T. Brandegee.*

3. **M. tenuiloba** Wats. Stems branching, woody at base, 1 to 1½ feet high; herbage short pilose and glandular; leaves ovate, acute, truncate or subcordate at base, 1 to 2 inches long, sometimes broader than long, shortly petioled; involucres subcylindric, 4 to 6 lines long, cleft to the middle or below into lanceolate or linear lobes; calyx white, hairy; fruit broadly ovoid, smooth, brown.

Colorado Desert and its western borders. Lower California.

Locs.—West Cañon, *Parish* 6072; Signal Mt., *T. Brandegee;* Coyote Sprs. and Mountain Wells, acc. *Standley.*

Refs.—MIRABILIS TENUILOBA Wats. Proc. Am. Acad. 17: 375 (1882), type loc. western edge of the Colorado Desert, *Wright.*

4. **M. californica** Gray. WISHBONE BUSH. Stems erect or ascending, many from the base, repeatedly forked, woody below, forming a bush 1 to 1½ feet high; herbage roughish puberulent to almost glabrous, the inflorescence glandular-pubescent; leaves ovate, mostly acute, subcordate or rounded at base, ½ to 1 inch long, shortly petioled; involucres 2 to 3 lines long, in terminal clusters or solitary in the axils, each involucre on a short peduncle; involucral lobes oblong-ovate, obtuse or acute, equaling or a little exceeding the tube; calyx rose-color or reddish, 4 to 6 lines long, narrowly campanulate, its spreading lobes deeply cleft into 2 somewhat diverging segments; fruit ellipsoidal, sometimes obscurely striate longitudinally, often lineate-mottled transversely, 1½ to 2 lines long.

Coast region from the Santa Lucia Mts. south to San Diego Co. Fl. Jan.-June. Variable in pubescence and apparently in shape and marking of fruits. Flowers open from middle of afternoon until next morning.

Locs.—San Diego, *T. Brandegee;* Del Mar, *Jepson* 1605; Playa del Rey, *Abrams* 2504; Santa Monica, *J. Q. Adams;* Santa Catalina Island, *Trask,* with peculiar flowers (Erythea, 7: 141); Santa Cruz Island, *T. Brandegee;* San Bernardino Valley, *Parish, Jepson* 5543; Saugus, *Davy;* San Luis Obispo Co., *Summers.*

Var. **glutinosa** Jepson n. comb. Herbage short-villous and glandular; leaves round-ovate, obtuse or acute, sometimes almost reniform; calyx white.—Colorado and Mohave deserts north to Inyo Co. Nevada.

Locs.—Red Hill, Bishop, *Heller* 8248; Pampa Sta., Kern Co., *Heller* 7644; Palm Cañon, *Jepson* 1390; San Felipe Creek below Banner, *T. Brandegee.*

Var. **retrorsa** Jepson n. comb. Herbage bright green, minutely and retrorsely scabrous, often sparingly so, especially on the stems; calyx white.—Mohave Desert, north to Washoe Co., Nevada.

Locs.—Barstow, *Jepson* 5371, 5375; Victor, *Hall* 6206.

Var. **aspera** Jepson n. comb. Herbage retrorsely pubescent or sometimes villous; leaves broadly ovate, obtuse or acute, subcordate at base, shortly petioled; calyx purplish red; fruit subglobose, brown, longitudinally 10-striate, the striae of lighter color.—Dry hills, Mohave Desert.

Refs.—MIRABILIS CALIFORNICA Gray in Torr. Bot. Mex. Bound. 169, 173, pl. 48 (1859), type loc. San Diego, *Parry, Thurber*. *Oxybaphus glabrifolius* var. *crassifolius* Choisy in DC. Prodr. 13²: 431 (1849), the type a Douglas plant from California, that is probably near Santa Barbara. Var. GLUTINOSA Jepson. *M. glutinosa* Nelson, Proc. Biol. Soc. Wash. 17: 92 (1904), type loc. Karshaw, Meadow Valley Wash, Nev., *Gooding*. *Hesperonia glutinosa* subsp. *gracilis* Stand. Contrib. U. S. Nat. Herb. 12: 365 (1909), type loc. Sabino Cañon, Ariz., *Toumey* 471c. Var. RETRORSA Jepson. *Mirabilis retrorsa* Heller, Muhl. 2: 193 (1906), type loc. Southern Belle Mine, Mono Co., *Heller* 8336. Var. ASPERA Jepson. *M. aspera* Greene, Erythea, 4: 67 (1896), type loc. Hesperia, *Parish* 3757, June 14, 1895.

M. LAEVIS Curran, Proc. Cal. Acad. ser. 2, 1: 235 (1888). *Oxybaphus laevis* Benth. Bot. Sulph. 44 (1844), type loc. Magdalena Bay. We have not seen the type but in a specimen from the type locality (*Lung* 28), which is essentially glabrous as described for the original, the very slightly unequal involucral lobes are narrower and more acuminate than in M. californica but no more unequal in size than in some specimens of the latter species which is, furthermore, often nearly glabrous. The two forms, M. laevis and M. californica, are probably identical, an opinion long ago expressed in the Proceedings of the California Academy, l. c.

M. CEDROSENSIS Jepson n. comb. (Hesperonia cedrosensis Stand. Contrib. U. S. Nat. Herb. 12: 362 (1909), type loc. Cedros Island, *T. Brandegee*). Stems rather slender, these and the leaves retrorsely scabrate; leaves thickish; fruit subglobose, not conspicuously striate longitudinally. Seems no more than a form of M. californica. Attributed doubtfully to San Clemente Island by Standley, l. c.

BATIDACEAE. BATIS FAMILY.

Low maritime bush or woody plant with opposite entire fleshy leaves. Flowers dioecious, crowded in catkins. Catkins sessile, axillary, disposed in terminal spikes. Staminate flower with a 2-lobed calyx, 4 stamens and 4 alternating petal-like staminodia. Pistillate flower without calyx or corolla, consisting of a 4-celled ovary with one ovule in each cell, and a sessile capitate stigma. Seed without endosperm; embryo slightly curved.—One genus.

1. BATIS P. Br.

Species 2 or 3, tropical shores. (Greek batis, the ancient name of some seashore plant.)

1. **B. maritima** L. Stems erect or ascending from a woody perennial base, ½ to 1 (or 3) feet high; leaves linear-oblanceolate, ½ to 1¼ inches long; staminate catkins 2 to 4 lines long, their bracts roundish, obtuse, 1 line long, or sometimes broader than long, disposed in 4 vertical rows, persistent; calyx splitting transversely across the top so as to make an anterior and a posterior lobe, about ¾ line long; staminodia white, nearly as long, with a roundish or triangular-hastate, somewhat cucullate appendage nearly equaling the slender filament; pistillate catkins 1 or 2 lines long, their bracts round-ovate, acute, deciduous; ovaries coherent, in fruit forming a fleshy spikelet 4 to 6 lines long.

Seashores: Southern and Lower California. Hawaiian Islands. East coast of America from Florida to Brazil.

Locs.—San Pedro, *McClatchie*; Newport, *Davidson*; San Diego, acc. Bot. Cal.

Refs.—BATIS MARITIMA L. Syst. ed. 10, 1380 (1759), type loc. Jamaica; Dammer in Engler & Prantl. Nat. Pflzfam. 3¹ᵃ: 119, fig. 71 (1893). *B. californica* Torr. Smithsonian Contrib. 6: 8, t. 11 (1853). Some authors regard the staminodial structures as petals.

Phytolaccaceae. PHYTOLACCA DECANDRA L. Sp. Pl. ed. 2, 631 (1762). Pokeweed. Tall perennial herb with reddish purple stems, alternate entire thin petioled leaves and flowers in racemes; sepals 5, petal-like, white, rounded, 2½ lines long; stamens 5 to 30; ovary lobed, several-celled, the styles as many as the cells; fruit a dark crimson or purple berry which is poisonous.—Lake Co., *Jepson*; Siskiyou Co. (Zoe, 4:158). Introduced from the eastern United States.

AIZOACEAE. Carpet-weed Family.

Ours prostrate or decumbent herbs. Flowers perfect and regular, either solitary or clustered. Calyx 4 or 5-lobed or -parted, either free from or more or less adnate to the ovary. Stamens hypogynous or commonly perigynous, fewer than the sepals or more numerous. Fruit a loculicidal or circumscissile capsule or indehiscent.—Species 450 in 18 genera, mostly African but occurring in all continents. Plants of widely divergent aspect and flower structure.

Calyx free from the ovary; petals none; leaves opposite.
- Capsule loculicidal, 3-valved; sepals 5; ovary 3-celled.
  - Stamens 3 to 5; herbage glabrous .... 1. Mollugo.
  - Stamens 5 to 10; herbage soft-pubescent .... 2. Glinus.
- Capsule circumscissile; calyx 5-cleft.
  - Stipules scarious, laciniate; ovary 1-celled; stamens 1 to 3 .... 3. Cypselea.
  - Stipules none; ovary 2 to 5-celled; stamens numerous .... 4. Sesuvium.

Calyx-tube adnate to the ovary, the flattish summit of the latter free.
- Petals none; leaves alternate, plane; fruit indehiscent .... 5. Tetragonia.
- Petals numerous; leaves opposite, 3-sided and very fleshy; fruit dehiscent .... 6. Mesembryanthemum.

1. MOLLUGO L. Carpet-weed.

Low glabrous much-branched annuals with whorled leaves and obsolete stipules. Flowers axillary, on slender pedicels. Sepals 5, scarious-margined, white within, thus resembling petals when expanded, persistent. Petals none. Stamens 5, hypogynous and alternate with the sepals, or 3 and alternate with the cells of the ovary. Stigmas 3. Capsule 3-celled, 3-valved, loculicidally dehiscent, the partitions breaking away from the many-seeded axis.—All continents, chiefly Old World tropics, 13 species. (Ancient Latin name for some soft plant.)

1. **M. verticillata** L. Indian Chickweed. Stems prostrate, slender, many from the base, 3 to 7 inches long, forming patches, not fleshy; leaves 5 or 6 in a whorl, unequal, oblanceolate, or spatulate, entire, 4 to 8 lines long; flowers several at each node; sepals oblong, 1 line long; capsule ovoid, scarcely exserted from the calyx; seeds reniform, shining, nearly smooth, obviously striate, crowded in the capsule and irregularly distending its half-transparent walls, which are thus roughened.

Native of the Old World tropics; introduced into California by way of Mexico; sparingly naturalized.

Locs.—Eagle Creek Cañon, Modoc Co., *Brewer* in 1862; Stillwater (Shasta Co.), *M. S. Baker* in 1898; Princeton, *Chandler* in 1905; Healdsburg, *Alice King* in 1897; Russian River, *Davy* in 1896; Visalia acc. *Coville;* Los Angeles, *Davidson* in 1893.

Ref.—Mollugo verticillata L. Sp. Pl. 89 (1753), "Africa, Virginia."

2. GLINUS L.

Annual herbs with whorled petioled leaves; very near Mollugo. Flowers pedicelled in dense glomerules in the upper axils. Stamens 5 to 10 or 20. Seeds with a strophiole, the funiculus very long and slender.—Species about 5, tropics and subtropics. (Greek name of Theophrastus for a maple, application to this genus unknown.)

1. **G. lotoides** Loefl. Diffusely branched from the base, the stems 4 to 8 inches long, procumbent or ascending; leaves orbicular to obovate, rounded at apex or abruptly acute, 3 to 6 lines long, at base narrowed to a slender petiole; flowers 2 lines long; stamens 5; seeds blackish, granulated.

Introduced into California from Europe, but only slightly established.

Locs.—Lathrop, *K. Brandegee;* Chico, *Parry;* Lakeport (Zoe, 4: 153).

Ref.—Glinus lotoides Loefl. Iter Hispan. 145 (1758), type loc. Spain.

3. CYPSELEA Turp.

Inconspicuous prostrate annual. Leaves opposite, those of each pair unequal, and with scarious laciniate stipules. Tube of calyx short, campanulate, the lobes (in ours) 5, ovate, unequal. Petals none. Stamens 1 to 3. Ovary superior, 1-celled; style 2-cleft. Fruit a subglobose circumscissile capsule. Seeds minute, smoothish, the funiculi persistent on the central placenta.—Species 1, West Indies. (Greek kupsele, a beehive, which the capsule is thought to resemble.)

1. **C. humifusa** Turp. Stems much branched and matted, the plants 1 or 2 inches broad; leaves oblong or elliptical, obtuse, 2 to 6 lines long, the petioles slender, nearly as long; stamens 3, rarely 1, inserted opposite the sinuses.

Immigrant from the West Indies, occurring sparingly in low lands and rarely seen.

Locs.—Lower San Joaquin River, *Congdon;* Aptos, *Parry.* Aug.

Ref.—CYPSELEA HUMIFUSA Turp. Ann. Mus. Par. 7: 219, t. 12, fig. 5 (1806), type loc. San Domingo.

4. SESUVIUM L.

Fleshy decumbent or prostrate herbs with opposite leaves and no stipules. Flowers solitary in the axils, sessile or shortly pediceled. Calyx-tube turbinate, the lobes 5, rose-pink inside, oblong, obtuse. Petals none. Stamens (in ours) numerous, inserted on the calyx. Ovary 2 to 5-celled, with as many separate styles. Capsule membranous, the upper part falling off as a lid. Seeds smooth. Embryo annular.—Species 5, chiefly tropical and subtropical coasts. (Latin Sesuvium, the country of the Sesuvii, a Gallic tribe mentioned by Caesar, the application to this genus unknown.)

1. **S. sessile** Pers. LOWLAND PURSLANE. Stems prostrate, freely branching, 1 to 3 feet long; herbage finely warty; leaves broadly spatulate, ½ to 2 inches long; flowers 4 to 5 lines long; sepals ovate-lanceolate, commonly acuminate, 3 lines long; ovary 2 or 3-celled, styles 2 or 3.

River lowlands and alkaline fields in the San Joaquin Valley and southward to Southern California. East to Kansas and south to Mexico. Brazil. May-Aug.

Locs.—San Joaquin Co., *Jepson;* Knights Ferry, *Sanford;* Palo Verde Valley, *Jepson* 5271; Blue Lake, Imperial Co., *Abrams* 3194; Ramona, *T. Brandegee;* Bakersfield, *Davy* 1771; Owens Lake, *Jepson* 5095; Bagdad, *T. Brandegee;* Nigger Slough, Los Angeles, *Braunton* 574.

Refs.—SESUVIUM SESSILE Pers. Syn. 2: 39 (1807). *S. portulacastrum* Brew. & Wats. Bot. Cal. 1: 251 (1876).

5. TETRAGONIA L. SEA SPINACH.

Ours a succulent annual with alternate plane leaves. Flowers axillary, greenish, apetalous. Calyx 4-lobed, its tube adnate to the 3 to 9-celled ovary. Stamens 1 to many, perigynous. Fruit a hard or bony nut, indehiscent, enveloped by the calyx which bears several horn-like protuberances.—About 25 species, nearly all southern hemisphere and chiefly South Africa. (Greek tetra, 4, and gonu, knee or angle, alluding to the fruit.)

1. **T. expansa** Murr. NEW ZEALAND SPINACH. Branches procumbent or prostrate; leaves rhombic-ovate, entire, 1 to 2½ inches long, abruptly contracted at base to a broad petiole, the surface covered with crystalline papillae; flowers subsessile, 1 to 3 in each axil; calyx-lobes widely spreading, yellowish within; fruit 4-horned, 4 to 6 lines long.

Native of Australasia, cultivated in California for use as summer greens and sparingly spontaneous on sea-beaches of the middle Californian coast.

Locs.—Pacific Grove, *Heller* 6275; Marin and Alameda cos. (Greene, Fl. Fr. 240); Fort Point and s. San Francisco (Zoe, 2: 352).

Refs. TETRAGONIA EXPANSA Murr. in Comm. Goetting. 6: 13, t. 5 (1783); Pax in Engler & Prantl, Nat. Pflzfam. 3^{1b}: 45, fig. 18 (1889).

6. **MESEMBRYANTHEMUM** L. Fig Marigold.

Ours herbs. Stems and leaves very succulent, without stipules. Flowers axillary and terminal. Calyx-tube adnate to the ovary, the lobes unequal and foliaceous. Petals linear, very numerous, inserted with the innumerable stamens on the tube of the calyx. Ovary 5 to 12-celled, the styles as many as the cells of the ovary and distinct or nearly so. Capsule becoming baccate, dehiscing in rainy weather by stellate valves at the flattened summit. Seeds minute, numerous. (Greek mesembria, mid-day, and anthemon, blossom.)

The 300 species of Mesembryanthemum are chiefly natives of South Africa, with a few in the Mediterranean region and in Australia. M. nodiflorum, M. crystallinum and M. aequilaterale seem out of place on the California coast and their status as native elements of our flora has been questioned. The balance of evidence as presented by Parish (The Californian Mesembrianthemums, Zoe, 1: 261) and by Greene (Pitt. 1: 82) is, however, strongly in favor of regarding them as indigenous plants, and these species are here so listed. The remaining species reported from California are, on the other hand, plainly adventitious or escapes from gardens. M. CORDIFOLIUM L. f. has the upper leaves petioled and cordate, and the flowers red. It has been cultivated in California for forty-five years or more, under the name of Dew Plant, and is an occasional escape from gardens (Zoe, 2: 352). M. PUGIONIFORME L. is a more recent arrival; stems from a thick perennial root; leaves linear-triquetrous, 2 to 5 inches long, mostly alternate but crowded in a basal tuft and towards the ends of the branchlets; calyx bowl-shaped, with caudate lobes, 7 to 10 or in fruit 10 to 14 lines broad.—Sparingly adventitious (Cliff House sand-dunes, San Francisco, *Hall* 4810; Pacific Grove, *Heller* 6717).

Annual; leaves alternate; herbage covered with shining vesicles; ovary 5-celled.
  Leaves linear, semiterete ....1. *M. nodiflorum.*
  Leaves ovate to spatulate, flat....................................2. *M. crystallinum.*
Perennial; leaves opposite, thick, dorsally carinate; herbage smooth; ovary 10 to 12-celled.... 3. *M. aequilaterale.*

1. **M. nodiflorum** L. Stems several from the base, prostrate or ascending; herbage covered with fine vesicles; leaves linear, 4 to 8 lines long, $\frac{1}{2}$ to 1 line wide; flowers solitary in the axils, subsessile or shortly peduncled; petals white, minute, much shorter than the calyx-lobes.

Southern California coast.

Locs.—San Juan, Orange Co., *Abrams* 3280; Lakeside, *Parish* 4428; San Diego, *Orcutt* 333; Santa Catalina Isl. acc. *Davidson* (Erythea, 1: 59).

Ref.—MESEMBRYANTHEMUM NODIFLORUM L. Sp. Pl. 480 (1753), type loc. Egypt.

2. **M. crystallinum** L. Ice-Plant. Stems repeatedly and rather shortly forked, 1 to 2 feet long; herbage covered with crystalline-dewy vesicles; leaves broadly ovate to broadly spatulate, $\frac{3}{4}$ to $1\frac{1}{2}$ inches long, narrowed to a short amplexicaul base, the lowest 2 to 5 inches long and nearly as broad and with a subcordate petioled base; calyx campanulate, 4 to 6 lines long; petals reddish, varying to white; ovary 5-celled.

Coast from Santa Barbara Co. south to San Diego. Lower California.

Locs.—Santa Monica, *Hall* 3277; Westminster, *Byram;* Coronado, *Hall* 3945; Santa Cruz Isl. (Greene, Bull. Cal. Acad. 2: 399); Mohave Desert, *K. Brandegee* (Zoe, 1: 263).

Ref.—MESEMBRYANTHEMUM CRYSTALLINUM L. Sp. Pl. 480 (1753), type loc. ? Africa.

3. **M. aequilaterale** Haw. Sea Fig. Stems several feet long, the plants forming extensive mats; leaves 3-sided, with nearly flat faces, thicker than broad, $1\frac{1}{2}$ to 2 inches long; flowers terminal, subsessile or shortly peduncled, fragrant and showy ($1\frac{1}{4}$ to 2 inches broad); petals bright rose-purple; ovary 9 to 12-celled.

Dunes and cliffs near the sea from Marin Co. southward to San Diego. In cultivation at Berkeley under the student name of "Faculty Onions." Also called "Beach-Strawberry."

Locs.—San Francisco; Ano Neuvo Pt., *Jepson;* San Luis Obispo (called "Beach-Apple"); Santa Cruz Isl. (Greene, Bull. Cal. Acad. 2: 399); San Miguel Isl. (Greene, Pitt. 1: 88).

Ref.—MESEMBRYANTHEMUM AEQUILATERALE Haw. Misc. Nat. 77 (1803), type Australasian.

PORTULACACEAE. Purslane Family.

Ours low herbs with succulent entire leaves and regular perfect flowers. Calyx chorisepalous (synsepalous and superior in Portulaca). Sepals 2 (or in Lewisia 2 to 8), fewer than the petals. Petals commonly 5 (3 to 16), opening only in sunshine, withering quickly. Stamens 3 to 20, sometimes more numerous, opposite the petals when of the same number. Ovary 1-celled, commonly superior; styles 2 to 8, united below or distinct, stigmatic along the inside. Fruit a capsule, dehiscent from the apex by 2 or 3 valves, or circumscissile and the top falling away as a lid.—About 140 species in 16 genera, all continents but mostly America.

Bibliog.—Gray, A., Portulacaceae [of N. Am.], (Proc. Am. Acad. 22: 272-285, -1887). Brandegee, K., Studies in Portulacaceae (Proc. Cal. Acad. ser. 2, 4: 86-91, 1894). Howell, Thos., Rearrangement of Am. Portulacaceae (Erythea, 1: 29-41,—1893).

Capsule 2 to 3-valved; sepals 2, distinct and free from the ovary, persistent.
  Style 1, stigmas 2; flowers mostly in scorpioid spikes; capsule 2-valved; sepals plane, scarious or scarious-margined..............................1. Calyptridium.
  Style-branches 3; sepals more or less concave.
    Flowers in leafy racemes or in panicles; petals commonly red, showy; stamens mostly 5 or more; seed numerous; annuals......................2. Calandrinia.
    Flowers in naked or merely bracteate racemes; petals commonly white or pinkish; seeds few (3 to 6).
      Stems from mostly fibrous roots; stamens 5 (or 3); annuals, or perennials by rhizomes or stolons..................................3. Montia.
      Stems from thick roots or corms; stamens 5.....................4. Claytonia.
Capsule circumscissile; stamens few to numerous.
  Sepals 2 to 8, distinct and free from the ovary, persistent................5. Lewisia.
  Sepals 2, united below and partly adherent to the ovary, the free upper portion deciduous.. 6. Portulaca.

1. CALYPTRIDIUM Nutt.

Herbs with alternate or basal spatulate leaves. Flowers small, in panicles or mostly in solitary or clustered scorpioid spikes. Sepals 2, scarious or scarious-margined, orbicular. Petals 2 to 4. Stamens 1, 2, or 3. Style simple; stigmas 2. Capsule membranous, 2-valved, few to many-seeded.—Species 6, western North America. (Greek kaluptra, a calyptra, the petals closing over each other and carried up on the capsule.)

Style very short, this and the 1, 2, or 3 stamens included; capsule 5 to 20-seeded.—Subgenus Eucalyptridium.
  Spikes not scorpioid, borne in a panicle; petals 3 (or 2); stamen 1; capsule 3 to 4 times length of fruiting calyx..1. *C. monandrum.*
  Spikes scorpioid, sometimes very short; capsule little or not at all surpassing fruiting calyx.
    Petals 2; stamen 1...2. *C. roseum.*
    Petals 4; stamens in same species 1, 2, or 3.
      Sepals not emarginate or reniform at base; Southern California....3. *C. parryi.*
      Sepals round-reniform; Clear Lake region................4. *C. quadripetalum.*
Style long, filiform, this and the 3 stamens exserted; capsule few seeded. Subgenus Spraguea.
  Spikes borne in an umbel or capitate-congested at summit of the scape-like stems........ 5. *C. umbellatum.*

1. **C. monandrum** Nutt. Annual; stems several from the base, spreading or prostrate, 1 or 4 to 9 inches long; leaves mostly in a basal rosette, some scattered along the stem, linear-spatulate, $\frac{3}{4}$ to 2 (or 3) inches long; flowers in short spikes in a terminal panicle; panicle 1 to 6 inches long; sepals 1 line long, little accrescent; petals commonly 3; capsule linear, compressed, becoming much exserted, 3 to 4 lines long, more or less curved on dehiscence, 5 to 10-seeded.

Monterey Co. south to San Diego, east to the Colorado and Mohave deserts and north to Kern and Inyo cos. Arizona.

Locs.—Nacimiento River, *Eastwood;* Hernandez, *Eastwood;* Ft. Tejon, acc. *Greene* (Fl. Fr. 181); N. Fork Kern River, *Purpus* 5720; Argus Peak, *Hall & Chandler* 6900; Barstow, *Jepson* 5379; Pampa, Kern Co., *Heller* 7641; Coachella, *Hall* 5811; Carrizo Creek, *T. Brandegee;*

Vandeventer, San Jacinto Mts., *Jepson* 1425; Cuyamaca, *T. Brandegee;* Del Mar, *K. Brandegee;* San Bernardino, *Parish* 4187; Santa Inez Mts., *Dunn;* Santa Cruz Isl., *Brandegee.*

Ref.—CALYPTRIDIUM MONANDRUM Nutt.; T. & G. Fl. 1: 198 (1838), type loc. San Diego, *Nuttall.*

2. **C. roseum** Wats. Annual; stems several from the base, decumbent, 1 to 3 lines long; leaves oblong-spatulate, 3 to 8 lines long, the basal ones few; flowers in very short scorpioid spikes; sepals orbicular-reniform, very shortly acute, green herbaceous with scarious margins, 1 to 1½ lines long; petals 2, minute; stamen 1; capsule not exceeding the calyx, 6 to 12-seeded.

Attributed to Telescope Peak, Panamint Range, by Coville with some doubt. Western Nevada to Oregon and Wyoming.

Locs. in Nev.—Miller Mt., Esmeralda Co., *Shockley* 666; Eagle Valley, Ormsby Co., *C. F. Baker* 1027.

Refs.—CALYPTRIDIUM ROSEUM Wats. Bot. King, 44, pl. 6, fig. 6-8 (1871), type loc. Truckee and Monitor valleys, Nev.; Cov. Contrib. U. S. Nat. Herb. 4: 73 (1893).

3. **C. parryi** Gray. Annual; stems several from the base, prostrate, 3 to 6 inches long; leaves spatulate, 4 to 8 lines long; spikes in age secund and scorpioid, 4 to 12 lines long; fruiting sepals orbicular or oval, herbaceous but white-margined, 1 to 2 lines long, a little shorter than the oblong capsule; style one-half length of the ovary; capsule valves minutely notched at summit.

San Bernardino and San Jacinto mountains, 6500 to 9300 ft.

Locs.—Bear Valley, *Parish* 3081; head of Willow Creek on trail to Round Valley, *Wilder* 942.

Ref.—CALYPTRIDIUM PARRYI Gray, Proc. Am. Acad. 22: 285 (1887), type loc. Bear Valley, *Parry, Parish.*

4. **C. quadripetalum** Wats. Annual; stems many, erect or spreading from a decumbent base, 2 to 4 (or 9) inches long; leaves basal and cauline, oblong-spatulate, 1 to 2 inches long including the tapering petiole; spikes dense, 3 to 8 lines long, terminating the leafy branches; sepals round-reniform, white-scarious and rose-tinged with greenish center, 2 to 4 lines broad, exceeding the 4 petals; capsule oblong-oval, 10 to 20-seeded, little or not at all surpassing the fruiting calyx.

North Coast Ranges in the region of Clear Lake. June.

Locs.—Geysers, Sonoma Co., acc. *Greene* (Fl. Fr. 182); Lake Co., *Towle, Simonds;* Kelsey, *K. Brandegee;* Allens Sprs., *Cleveland;* Snow Mt., *T. Brandegee.*

Ref.—CALYPTRIDIUM QUADRIPETALUM Wats. Proc. Am. Acad. 20: 356 (1885), type loc. Snow's Ranch, headwaters of Eel River in Lake Co., *Rattan.*

5. **C. umbellatum** Greene. PUSSY PAWS. Annual, biennial or perennial; stems several, erect or ascending, scape-like, 3 to 15 inches high, arising from a dense rosette of leaves; basal leaves spatulate, 1 to 2 (or 4) inches long, the cauline leaves few and similar, or mostly reduced, or none; flowers imbricate-crowded in scorpioid spikes; spikes borne in a terminal umbel or whorl, 3 to 6 lines long, on peduncles ½ to 2 times as long; sepals orbicular, emarginate at base and apex, equal, wholly scarious or with a mere greenish center, dull white or often pink, in age 2 to 4 lines broad; petals 4, pink or white, obovate; stamens 3, each filament enfolded by a half-involute petal, the fourth petal embracing the style; stamens and the long style exserted; ovules 3 to 6 (or 10); capsule globose-ovate, 1 or 2-seeded; seed black, shining, microscopically tesselate.

Fine gravelly or sandy soil, common in open places in the mountains, on plateaus, slopes, valley floors, or washes, 2500 or 4000 to 8000 feet: Sierra Nevada and Coast Ranges. North to British Columbia, east to Nevada and the northern Rocky Mts. June-Sept.

Locs.—Santa Cruz, *Anderson* (only known station in South Coast Ranges); South Yollo Bolly, *Jepson;* Trinity Summit, *Jepson* 2040; Shackelford Cañon, w. Siskiyou, *Jepson* 2816; Egg Lake, Modoc Co., *M. S. Baker;* Plumas Co., *Platt;* Truckee, *Sonne;* Bear Valley, Nevada Co., *Jepson;* upper Stanislaus River, *Greene;* Yosemite, *Torrey* in 1865, *Jepson* 4259; Marble Fork Kaweah River, *Jepson* 659; Mt. Silliman, *Jepson* 723; Bubbs Creek, *Jepson* 837; Horseshoe Mdw. near Mt. Whitney, *Jepson* 931.

Jepson, Fl. Cal. vol. 1, pp. 433-464, 3 Jan. 1914.

Var. **caudicifera** Jepson n. comb. Alpine perennial, all the parts much reduced; caudex branching, the branchlets short and densely leafy, bearing one terminal scape-like stem ½ to 2 inches high; leaves 3 to 6 (or 10) lines long; flowers glomerate-capitate.—Sierra Nevada, 8000 to 13,000 feet; north to Washington and east to Wyoming.

Locs.—Mt. Whitney, *Jepson* 1073; Mt. Dana, *Jepson* 3288; Dana Fork, Tuolumne River, *Jepson* 3261; Macomb Ridge, Yosemite Park, *Jepson* 4560; Mt. Shasta, *Jepson.*

Refs.—CALYPTRIDIUM UMBELLATUM Greene, Bull. Torr. Club, 13: 144 (1886). *Spraguea umbellata* Torr. Pl. Frem. 4, pl. 1 (1853), type loc. "forks of Nozah River," n. Sierra Nevada foothills west of Lassen Peak, *Fremont;* Hook. Bot. Mag. t. 5143 (1859).

This species is the type of the genus Spraguea Torr. l. c., a genus which was invalidated by the discovery of Calyptridium quadripetalum Wats. The latter species is an undoubted Calyptridium and yet it is most interestingly related to Spraguea on account of its scorpioid flower-imbricated spikes and scarious orbicular round-reniform sepals. Calyptridium umbellatum is variable but scarcely as much so as the following synonymy would indicate. *C. nudum* Greene, Pitt. 1: 64 (1887), type loc. Donner Lake, *Sonne. C. monospermum* Greene, Erythea, 3: 63 (1895), type loc. Big Cottonwood Mdws. near Mt. Whitney, *Koch. Spraguea pulchella* Eastw. Bull. Torr. Club, 29: 79 (1902), type loc. Pea Ridge Road, Mariposa Co., *Congdon;* petals oblong to linear, acute; ovary 1 or 2 ovuled.—Ex. char. *S. eximia* Eastw. l. c. 30: 486 (1903), type loc. Sulphur Banks, Lake Co., *Agnes Bowman;* stamens not quite as long as petals.—Ex. char.

Var. CAUDICIFERA Jepson. *Spraguea umbellata* var. *caudicifera* Gray in Patterson, Check-list N. Am. Pl. 14 (1892). *S. multiceps* Howell, Erythea, 1: 39 (1893), type locs. Mt. Hood and Mt. Adams.

2. CALANDRINIA H.B.K.

Ours low fleshy annuals with alternate entire leaves and ephemeral red or rose-colored flowers, rarely varying to white. Flowers in a leafy raceme or in a panicle. Sepals 2, persistent. Petals 5, rarely more or less (3 to 7). Stamens 5 to 14, rarely 3, seldom of the same number as the petals. Style-branches 3. Capsule 3-valved from the apex. Seeds numerous, black and often shining.—(J. L. Calandrini, Swiss botanist.)

Calandrinia has its greatest development in the southern hemisphere. There are about 60 species on the Pacific Coast of the two Americas, chiefly in Chile, and 16 species in Australia. C. caulescens, C. breweri and C. maritima are perhaps introduced into California from the southward. The var. menziesii of the first named, in particular, behaves strangely like an immigrant.

Flowers in a raceme or mostly so; seeds with a strophiole.
  Herbage green; calyx green; racemes erect; pedicels clavate-thickened and a little angled; seed black and shining, apparently smooth but microscopically papillate, the strophiole white, minute.
    Capsule enveloped by the fruiting calyx, the latter as long or nearly; branches mostly ascending or erect; common............................1. *C. caulescens.*
    Capsule nearly twice as long as the fruiting calyx; branches mostly trailing; rare.... 2. *C. breweri.*
  Herbage glaucous; calyx and bracts black-veined or -mottled; racemes a little drooping at apex, the pedicels filiform; seed roughish, with a large strophiole; rare..... 3. *C. maritima.*
Flowers in an umbellate panicle; seeds without a strophiole; Colorado Desert...4. *C. ambigua.*

1. **C. caulescens** H. B. K. Stems spreading or ascending, 6 to 12 inches high; leaves narrowly oblanceolate to linear, acute, 1 to 2 inches long, somewhat succulent; flowers short-pediceled; pedicels erect; sepals ovate, apiculate or short-acuminate, glabrous or somewhat hispidulous on the margins or midribs; petals 5, red, obovate, obtuse, 2 to 4 lines long; stamens 3 to 6, sometimes more; capsule ovate, short-pointed, enveloped by the sepals which are nearly or quite as long.

Humboldt Co. and southeastern California; Arizona; south to Bolivia.

Var. **menziesii** Gray. RED MAIDS. (Fig. 92.) Stems 1 to several or many from the base, simple or sparingly branched, diffuse, or erect and simple, ½ to 2 feet long; pedicels long (5 to 11 lines long) or sometimes short (3 to 5 lines long); petals orbicular-obovate, retuse at apex, crimson or rose-red, 3 to 5 lines long; stamens 7 to 14, commonly 10 to 12, rarely fewer than 7.—Orchards and vineyards, often very abundant in wet years; also in fields and on hilltops. Mar.-Apr. Flowers opening of afternoons. Called "Kisses" in Solano Co.

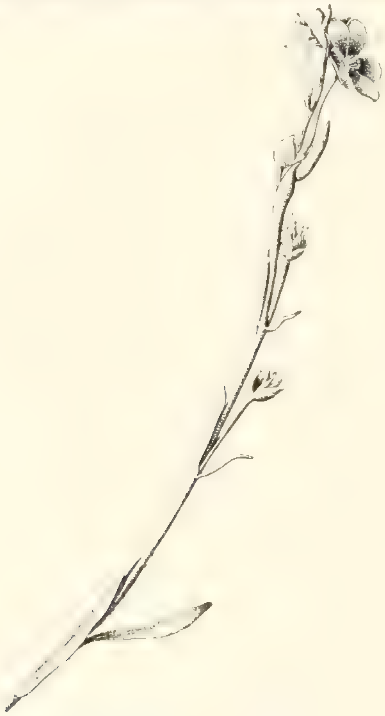

Fig. 92. CALANDRINIA CAULESCENS var. MENZIESII Gray; portion of flowering branch, x 1.

Locs.—Egg Lake, Modoc Co., *Baker;* Crane Creek, Tehama Co., *Jepson;* Elk Grove, *Drew;* Vacaville, *Jepson* 520; Napa Valley, *Jepson;* Collinsville, *Jepson;* Amador Co., *Hansen* 907; Clements, San Joaquin Co., *Jepson* 1823; French Camp, *Sanford;* Berkeley, *Jepson;* Stanford University, *C. F. Baker* 277; Grapevine Spr., Tulare Co., *Woolsey;* San Bernardino, *Parish.*

Refs.—CALANDRINIA CAULESCENS H. B. K. Nov. Gen. & Sp. 6: 78, t. 526 (1823), type locs. Bolivia and Mexico. Var. MENZIESII Gray, Proc. Am. Acad. 22: 277 (1887). *C. menziesii* T. & G. Fl. 1: 197 (1838). *Talinum menziesii* Hook. Fl. Bor. Am. 1: 223, t. 70 (1834), type from "N. W. America" south of the Coulmbia River, probably California, *Menzies.*

2. **C. breweri** Wats. Stems lax, trailing or sometimes ascending, 1 to 2 feet long; leaves spatulate or oblong-spatulate, 1 to 2½ inches long; flowers sparse; pedicels longer than in no. 1, typically deflexed in fruit; capsule narrower and longer (5 to 6 lines long) than in no. 1, at length twice or nearly twice as long as the calyx; sepals with a grooved edge, the lower margin of the groove scarious. Coast Ranges and Sierra Nevada; Lower California. The known localities few and scattered. June.

Locs.—Coulterville, *Congdon;* Mt. Tamalpais, *Jepson;* Painted Cave Ranch, Santa Barbara, *Eastwood;* San Bernardino Mts., *Parish* 6221; Santa Cruz Isl. (Zoe, 1: 133).

Refs.—CALANDRINIA BREWERI Wats. Proc. Am. Acad. 11: 124 (1876), type loc. Santa Inez Mts., *Brewer;* Brandegee, Zoe, 2: 121 (1891). *C. menziesii* var. *macrocarpa* Gray, Proc. Cal. Acad. 3: 102 (1864), type the same as C. breweri.

3. **C. maritima** Nutt. Stems several from the base, spreading or ascending, 3 to 8 inches long; herbage very glaucous; leaves mostly basal or on lower part of stem, spatulate-obovate, narrowed to a petiole-like base, 1 to 2½ inches long; flowers long-pediceled in a terminal raceme or loose panicle, ¼ to 1¼ inches long; flowers red; sepals round-ovate, dark-veined, mucronate or abruptly short-acute, slightly surpassed by the ovate capsule.

Southern California coast. Lower California.

Locs.—Santa Monica (Gray, Syn. Fl. 1^1: 270); San Diego, *Abrams* 3461; Santa Cruz Isl. (Zoe, 1: 133).

Ref.—CALANDRINIA MARITIMA Nutt.; T. & G. Fl. 1: 197 (1838), type loc. San Diego, *Nuttall.*

4. **C. ambigua** Howell. Stems several from the base, erect or a little spreading, 2 to 7 inches high; stems and leaves very succulent; leaves linear-spatulate, 1 to 1½ inches long; flowers pediceled in rather compact umbellate panicles; pedicels 1 to 3 lines long; sepals ovate with shortly acute spreading tips and

white-scarious margins, 1 to $2\frac{1}{2}$ lines long, equaling or exceeding the 5 obovate white petals; stamens 5 (or 6 to 8); seeds many.

Colorado Desert. Apr.-May.

Locs.—Coachella, *Greata;* Borrego Spr., *T. Brandegee;* McCoy Wash, *Hall* 5947; Indio, acc. *Parish.*

Refs.—CALANDRINIA AMBIGUA Howell, Erythea, 1: 34 (1893). *Claytonia ambigua* Wats. Proc. Am. Acad. 17: 365 (1882), type loc. El Rio, Colorado River, *Lemmon. Calandrinia sesuvioides* Gray, Proc. Am. Acad. 22: 278 (1887).

3. **MONTIA** L. INDIAN LETTUCE.

Moderately succulent low herbs, very glabrous and often glaucous. Stems usually clustered. Leaves alternate, opposite, or basal. Flowers white or pinkish, commonly nodding in the bud, usually reopening the second or third day, borne in racemes or clusters, sometimes solitary. Pedicels commonly spreading or recurved in fruit. Sepals 2, persistent. Petals 5, equal or somewhat unequal, distinct, or more or less connate at base. Stamens 5 or 3. Style-branches 3. Capsule 3-valved from the apex, 1 to 3-seeded.—About 20 species, chiefly western North America, one species cosmopolitan. (Giuseppe Monti, Italian botanist, died 1760.)

Our representatives of the genus fall into groups of a few closely related species. The species in a group sometimes differ by slight characters and tend to run together. Montia perfoliata is especially variable; while its extreme variants are sufficiently pronounced for specific rank, such status is precluded by numerous intermediate forms. Moreover occasional plants, fairly typical of the species, show in their development stages similar to the various forms here listed as varieties. All of the species have the pedicels more or less recurving in fruit, save that in Montia sibirica the spreading or deflexed pedicels remain straight.

A. Petals united at base into a tube, not notched at apex.

Stamens 3; petals unequal; leaves opposite..............................1. *M. fontana.*

B. Petals distinct or a little united, commonly notched at apex.

1. Leaves alternate; petals equal or unequal.

Stamens 3; annuals; petals unequal.
Petals minute; upper leaves scarious-dilated at base....................2. *M. howellii.*
Petals 2 lines long; leaves less scarious-dilated at base or scarcely at all so........... 3. *M. linearis.*

Stamens 5; petals equal.
Stems diffuse, dichotomous; annual......................................4. *M. diffusa.*
Flowering stems simple and scape-like; perennial by stolons or bulblets. 5. *M. parvifolia.*

2. Leaves basal or opposite; petals equal; stamens 5.

Stems bearing several pairs of opposite leaves; racemes axillary or terminal; perennial by bulblets ....6. *M. chamissoi.*

Stems bearing one pair of leaves, these opposite; racemes terminal.
Cauline pair of leaves more or less united; annuals.
Cauline pair of leaves united into a roundish or angular disk; petals commonly white and usually little surpassing the sepals; rather coarse annual.7. *M. perfoliata.*
Cauline pair of leaves not forming a disk, partially joined on one side.
Stems slender; petals commonly pink, 3 times as long as sepals.............. 8. *M. gypsophiloides.*
Caespitose dwarf; petals white, little exceeding sepals.......9. *M. spathulata.*
Cauline pair of leaves quite distinct.
Pedicels 1 to 3 lines long; annuals.
Plant somewhat diffuse; leaves narrowly linear................10. *M. exigua.*
Plant a succulent ball; leaves obovate or spatulate, nearly sessile........... 11. *M. saxosa.*
Pedicels $\frac{1}{2}$ to 2 inches long.
Pedicels bracteate; annuals or perennials.
Stem from a thick crown or short rootstock; coast........12. *M. sibirica.*

Stem from tuberous rootstock or cormlet; high southern Sierra...........
13. *M. heterophylla.*
Pedicels bractless; plants with horizontal rootstock..........14. *M. asarifolia.*

1. **M. fontana** L. Water Chickweed. Annual, or sub-perennial by rooting at the nodes; stems slender, 2 to 6 inches long, ascending or procumbent; leaves opposite, narrowly oblanceolate to spatulate-obovate or oblong, slightly connate at base, 2 to 10 lines long; racemes loose, 3 to 9-flowered; sepals ½ to 1 line long; petals minute, white, unequal, united at base, and exceeding little the sepals; seeds minute, roughened.

In water on margins of small surface streams or in muddy places. Occasional throughout California. Northward to British Columbia and far across the continent. Of world-wide distribution. Mar.-May.

Locs.—Coast Ranges: Berkeley Hills, *Tracy* 540; San Bruno Hills, *Jepson;* San Francisco, *Chesnut;* Ross Valley, *Drew;* Pt. Reyes, *Greene;* Kenwood, *Bioletti;* Rutherford and Calistoga, *Jepson;* Snow Mt., *T. Brandegee;* Eureka, *Tracy* 2955; Oro Fino, Siskiyou Co., *Butler* 679. Sierra Nevada: Jackson, *Hansen;* Webber Lake, *Kennedy & Doten;* Ft. Bidwell, *Manning* 116. Southern California: Witch Creek (Erythea, 3: 60). The var. TENERRIMA Fernald occurs in Indian Valley, Plumas Co., acc. Gray; it is very slender with mostly broad-spatulate petioled leaves in only 2 or 3 pairs, long-peduncled inflorescence, and sepals barely 1 line long.

Refs.—Montia fontana L. Sp. Pl. 87 (1753), type European; Jepson, Fl. W. Mid. Cal. 187 (1901). Var. TENERRIMA Fern., Rhod. 12: 138 (1910). *Claytonia chamissonis* var. *tenerrima* Gray, Proc. Am. Acad. 8: 378 (1872), type loc. Ore., *Elihu Hall. C. hallii* Gray, l. c. 22: 283 (1887), type same as in var. tenerrima Fern. *Montia hallii* Greene, Fl. Fr. 180 (1891), "corolla twice the length of the calyx".

2. **M. howellii** Wats. Annual; stems simple or branching, diffuse or procumbent, ½ to 2 inches long; leaves alternate, elongated linear-spatulate, 4 to 10 lines long; racemes axillary, umbellately 2 or 3-flowered, shorter than the leaves; leaves opposite the racemes with a rather broad scarious-dilated clasping base, the racemes subtended by an ovate or short scale-like scarious bract; petals 3 or 4, unequal, minute, sometimes absent; stamens 3; seeds shining, microscopically foveolate-lineate.

Very wet soil, coast region: Humboldt Co. north to Washington.

Ref.—Montia howellii Wats. Proc. Am. Acad. 18: 191 (1883), type loc. Sauvies Isl., Ore., *Jos. & Thos. Howell.* Perhaps this is an alternate-leaved variety of M. fontana, with which it quite agrees in habit.

3. **M. linearis** Greene. Annual, nearly simple or very much branched, erect, 1 to 6 inches high; leaves alternate, narrowly and elongated linear (1 to 2½ inches long and ½ to 1 line wide), sessile by a clasping base; racemes terminal, commonly secund, about 4 to 8-flowered; pedicels 2 to 5 lines long; sepals broad and rounded or almost truncate, white-margined, straw-color in age; petals white, unequal, narrowly obovate, narrowed at base or clawed, slightly united on one side and not on the other side, 2 to 2½ lines long, slightly exceeding the sepals; stamens 3, inserted on the very base of the smaller petals; seeds lenticular, nearly or quite 1 line broad, smooth and shining, finely reticulated under a lens.

Wet banks: central Sierra Nevada, 3000 to 4500 feet, and Coast Ranges. East into Nevada, north to British Columbia and Montana.

Locs.—Coast Ranges: Las Trampas, Contra Costa Co., *Hall* 1626; Napa Valley, *Bigelow* in 1854 (acc. Pac. R. Rep. 4: 71); Yager, Humboldt Co., *Blankinship;* Yreka, *Butler* 680; Oro Fino, *Butler* 677. Sierra Nevada: Yosemite, *Harriet Walker* 2432; Pioneer, Amador Co., *Hansen;* Prosser Creek, Nevada Co., *Sonne;* Prattville, *Brandegee;* Forestdale, Modoc Co., *M. S. Baker;* Ft. Bidwell, *Manning* 99.

Refs.—Montia linearis Greene, Fl. Fr. 181 (1891); Jepson, Fl. W. Mid. Cal. ed. 2, 162 (1911). *Claytonia linearis* Dougl.; Hook. Fl. Bor. Am. 1: 224, pl. 71 (1834), type loc. Great and Little Falls of the Columbia River, *Douglas.*

M. DICHOTOMA Howell, Erythea, 1: 36 (1893). Similar to M. linearis but smaller in all its parts; diffuse or depressed, branching from the base and above, 1 to 3 inches high; leaves linear, 1 inch long or less; flowers many and secund in a dense terminal raceme; sepals 1 line long, the petals unequal, white, slightly longer; seeds dull, $\frac{1}{3}$ to $\frac{1}{2}$ line broad.—Oregon and Washington. Yreka acc. Bot. Cal. 2: 436. (*Claytonia dichotoma* Nutt.; T. & G. Fl. 1: 202,—1838, type loc. mouth of the Willamette River, *Nuttall.*)

4. **M. diffusa** Greene. Annual, diffusely branched from the base, 2 to 6 inches high; cauline leaves alternate, deltoid-ovate to ovate or the upper narrowly ovate, acute, $\frac{1}{2}$ to 1 inch long, the petiole nearly as long or longer; racemes 2, 3, or 4 on a branch, opposite the upper leaves or terminal, 1 to $1\frac{1}{2}$ inches long, each 4 to 7-flowered; petals emarginate, white or pink, equal, 2 lines long, slightly exceeding the sepals; pedicels deflexed or divergently spreading in fruit; seeds black, $\frac{1}{2}$ line long, lineated, the lineations composed of narrow transverse plates.

Under pines in the coast region: Marin Co. to Humboldt Co. North to Washington. Rare.

Locs.—Mill Valley, *Eastwood;* San Rafael, *Henry Edwards* in 1878; near Buck Mt., Van Duzen River, *Tracy* 2725.

Refs.—MONTIA DIFFUSA Greene, Fl. Fr. 181 (1891); Jepson, Fl. W. Mid. Cal. 187 (1901). *Claytonia diffusa* Nutt.; T. & G. Fl. 1: 202 (1838), type loc. Ft. Vancouver, Columbia River, *Nuttall.*

5. **M. parvifolia** Greene. Flowering stems erect or slightly spreading, whip-like or filiform and somewhat scape-like, 5 to 9 or 12 inches high, arising from the lower axils of Sedum-like rosettes of leaves borne on short caudex-like stems; these caudices also produce filiform surface runners; leaves of the rosettes ovate to oblanceolate, acute, 3 to 7 (or 10) lines long, passing into petioles as long or nearly; leaves of the flowering stems reduced above, small and bract-like (2 to 4 lines long), and bearing in their axils fleshy bulblets which fall away readily, the plant perennial by these; flowers umbellately racemose; racemes 2 to 7-flowered; sepals roundish, 1 line long, the petals equal, white or pink, retuse, 3 to 5 lines long; capsule mostly 1-seeded; seed rather dull, with minute pits.

Mossy surface of rocks and moist banks: Coast Ranges; Sierra Nevada from Yosemite northward. Far north to Alaska, east to Montana.

Locs.—Coast Ranges: Little Sur River, *T. Brandegee* (only known station in South Coast Ranges); Mt. Tamalpais (Zoe, 4: 68); Sonoma Creek, *M. S. Baker;* Navarro, *Edith Byxbee;* Jarnigan's, Humboldt Co., *Chesnut & Drew;* Redwood Creek, Humboldt Co., *Jepson* 1961; Humboldt Co., *Tracy* 2708 (near Buck Mt.), 3226 (Little River); Hupa Valley, *Chandler* 1261; Preston Peak, Klamath Range, *Jepson* 2880. Sierra Nevada, 4000 to 8200 ft.: Yosemite Park, *Jepson* 4350 (Yosemite Falls), 3137 (Vernal Fall), 4576 (Kerrick Cañon), 4575 (Stubblefield Cañon); Little Chico Cañon, *R. M. Austin.*

Refs.—MONTIA PARVIFOLIA Greene, Fl. Fr. 181 (1891); Jepson, Fl. W. Mid. Cal. 187 (1901). *Claytonia parvifolia* Moq. in DC. Prodr. 3: 361 (1828), type loc. Nootka, Vancouver Island. *C. filicaulis* Hook. Fl. Bor. Am. 1: 224, t. 72 (1834). *Montia obtusata* Heller, Muhl. 2: 32 (1905), type loc. Shasta Retreat, Siskiyou Co., *Heller* 7945.

6. **M. chamissoi** Dur. & Jac. TOAD-LILY. Stems decumbent or ascending, 2 to 6 inches or 1 foot long, leafy to the top, rooting at the lower nodes; perennial by means of little tuber-like bulblets produced at the end of slender runners; leaves opposite, oblanceolate to oblong-obovate, obtuse or acute at apex, tapering into a petiole at base, $\frac{1}{2}$ to 1 (or 2) inches long; racemes axillary or terminal, 2 to 8-flowered, rarely 1-flowered, bractless except 1 or 2 small bracts at base; sepals orbicular, 1 line long, the petals white or pink, elliptic, rounded at apex and entire, or sometimes retuse, 3 to 4 lines long; capsule small; seeds muriculate-roughened.

Wet or swampy meadows or moist stream borders: Sierra Nevada, 4000 to 9000 feet, and North Coast Ranges. North to Alaska.

Locs.—Sierra Nevada: Greenhorn Range, *Hall & Babcock* 5051; Golden Trout Creek, *Jepson* 4932; Cottonwood Creek, Inyo Co., *Jepson* 5075; Pine Ridge, Fresno Co., *Hall & Chandler* 106; Tuolumne Mdws., *Jepson* 3242; Bloody Cañon, Mono Co., *Jepson* 4440 (petals 5 or 6, the stamens as many); Spur, Alpine Co., *Hansen;* Blue Cañon, *Harriet Walker* 1359; Truckee, *Sonne;* Prattville, *Brandegee;* Ft. Bidwell, *Manning* 115. Coast Ranges: Snow Mt., *Brandegee;* Mt. Pinos, *Hall* 6650. Southern California: Tamarack Valley, Mt. San Jacinto, *Hall* 2362; Bear Valley, San Bernardino Mts., *Parish.*

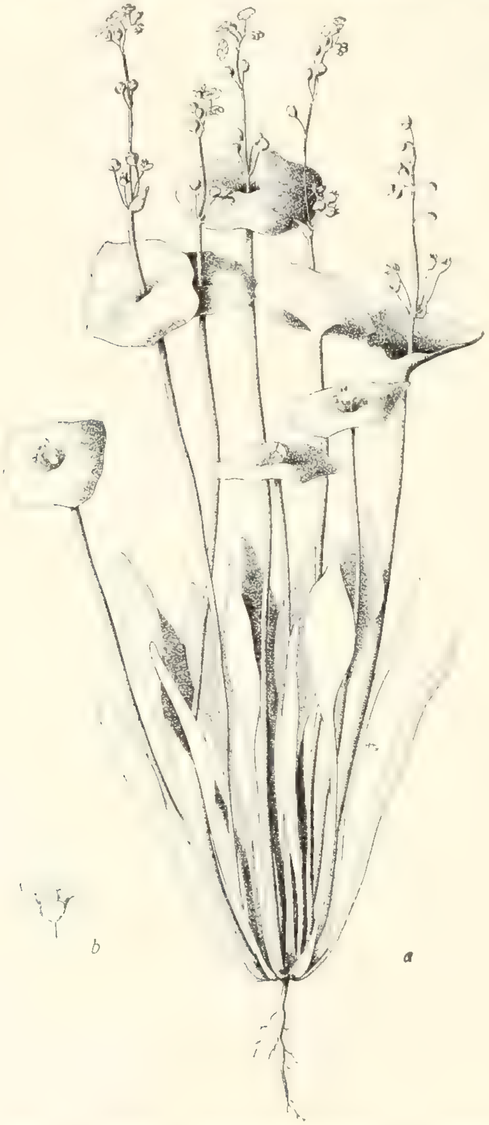

Fig. 93. Montia perfoliata Howell. *a*, a large plant drawn one-third the natural size; *b*, flower, x 1. The plants vary greatly in size according to situation, often becoming very small or depauperate.

Refs.—Montia chamissoi Dur. & Jac. Index Kew. Sup. 1: 282 (1901). *Claytonia chamissoi* Ledeb. in Spreng. Sys. Veg. 1: 790 (1825), type loc. Aleutian Islands; Cov. Contrib. U. S. Nat. Herb. 4: 72 (1893); Holzinger, Pl. World, 4: 41 (1901). *C. chamissonis* Esch. Linnaea 6: 562 (1831). *Montia chamissonis* Greene, Fl. Fr. 180 (1891); Jepson, Fl. W. Mid. Cal. ed. 2, 161 (1911). *Crunocallis chamissonis* Rydb. Bull. Torr. Club, 33: 139 (1906).

7. **M. perfoliata** Howell. Miner's Lettuce. (Fig. 93.) Annual; stems several, erect or diffuse, 4 to 10 (or 16) inches high; basal leaves rhomboidal or deltoid to ovate or lanceolate or the earliest narrowly linear, ½ to 2 inches long, long-petioled; cauline pair completely united into a round and entire or angulately 2-lobed disk ½ to 2 (or 4) inches broad; racemes more or less interrupted (the flowers in 2s or 3s or fascicles), variable in length, sessile or on peduncles ¼ to 1½ inches long, or the flowers glomerate on the disk in a sessile cluster; pedicels 1 to 5 lines long, rarely ¾ inch; sepals roundish, 1 to 2 lines long; petals white, 1¼ to 1½ times length of sepals.

Mostly in the shade of oaks and other trees throughout California, also common in orchards and vineyards: Coast Ranges (mostly valleys and lower foothills); Great Valley; Sierra Nevada (mostly cañon valleys and foothills, but ranging to middle altitudes); Southern California ("common in the valleys and ascending the mountains to 7000 feet, becoming exiguous at the upper limit."—Parish). Extends north to British Columbia and south into Lower California. Also called Indian Lettuce and Squaw Cabbage.

Plants growing in one spot, of like aspect and habit and not differing save for marked variations in some one organ, may often be discovered by the field student. Extreme variability in size according to soil or situation is characteristic of this species. It is also highly variable in the size and shape of its basal leaves, as well as of those forming the cauline disk. Plants in a colony at Palomar (*Jepson* 1494) were quite alike save that the individuals showed, altho inconstantly, the following variations in cauline leaves: *a*, cauline pair completely united into a perfoliate disk, and entire or toothed; *b*, cauline pair united into a perfoliate disk split down one side; *c*, cauline pair ovate or lanceolate, distinct; *d*, cauline pair ovate or lanceolate, partly united on one side.

Locs.—Linden, San Joaquin Co., *Gunnison;* Amador Co., *Hansen* 35; Hazel Green, *Jepson;* Grapevine Spr., Tulare Co., *Woolsey;* Panamint Mts., *Hall* 6971; St. Helena, *Jepson;* Ross Valley, *Jepson;* Berkeley, *Jepson;* San Francisco, *K. Brandegee;* Los Gatos, *Heller;* Pacific Grove, *Tidestrom;* Elizabeth Lake, *Hall* 3090; Elysian Hills, Los Angeles, *Braunton* 164; Santa Ana Cañon, San Bernardino Mts., *R. J. Smith.*

Var. **parviflora** Jepson n. comb. Same as the species in habit, but more slender; basal leaves filiform-linear or linear-spatulate; calyx 1 line long; petals white or rose-color.—Damp shady places. General range of the species. In the form in which it occurs in California this seems no more than a narrow-leaf state of M. perfoliata and is here so treated; its seeds are not different. Lower California. North to Washington.

Locs.—Yreka, *Butler* 675, 1305, 1550; Little River, Humboldt Co., *Tracy* 3211; Redding, *Heller* 7900; Tehama Co., *Jepson;* Deer Creek Ridge, w. Nevada Co., *Jepson;* Amador Co., *Hansen;* Santa Clara Co., *C. F. Baker* 487; Girard, Kern Co., *Heller* 7716.

Var. **nubigena** Jepson. Compact or caespitose plant with glaucescent herbage and numerous stems; leaves linear or a few spatulate at apex; racemes dense; petals white or pinkish, 3 lines long.—Mountain peaks, central Coast Ranges.

Locs.—Mt. Tamalpais, *Jepson;* Mt. Diablo, *Greene;* Mt. Hamilton (Pitt. 2: 294).

Var. **depressa** Jepson n. comb. Small and depressed, 1 to 4 or 5 inches high, the plant often livid red; basal leaves rhomboidal or broadly ovate, 2 to 6 lines broad, often broader than long, petioled; cauline disk split down one side or its leaves only partly united, subtending sessile glomerules or subumbellate clusters of flowers; petals twice as long as calyx. Northern California to British Columbia. Often in pine woods.

Locs.—Humboldt Bay, *Tracy* 3129; Dunsmuir, *Heller* 7924; Siskiyou Co., *Butler* 676 (Oro Fino), 1289 (Humbug Mt.); Forestdale, *Baker & Nutting;* Ft. Bidwell, *Manning* 74.

Refs.—MONTIA PERFOLIATA Howell, Erythea, 1: 38 (1893); Jepson, Fl. W. Mid. Cal. 186 (1901). *Claytonia perfoliata* Donn, Ind. Hort. Cantab. 25 (1796); Willd. Sp. Pl. 1: 1186 (1798); type from N. Am. *C. perfoliata* var. *amplectens* Greene, Fl. Fr. 179 (1891), type loc. middle elevations, Sierra Nevada; cauline pair of leaves united on one side only. Var. *carnosa* Greene, l. c. 178, type loc. Mt. Diablo; very succulent; seed nearly orbicular.—Ex. char. Var. PARVIFLORA Jepson. *Claytonia perfoliata* var. *parviflora* Torr. Pac. R. Rep. 4^5: 71 (1857). *Claytonia parviflora* Dougl.; Hook. Fl. Bor. Am. 1: 225, t. 73 (1834), type loc. Columbia River, *Douglas.* *C. perfoliata* var. *angustifolia* Greene, Fl. Fr. 179 (1891), type Californian. *Limnia parviflora* Rydb. Bull. Torr. Club, 33: 139 (1906). *Montia parviflora* Howell, Erythea, 1: 38 (1893). Var. NUBIGENA Jepson, Fl. W. Mid. Cal. 186 (1901). *Claytonia nubigena* Greene, Pitt. 2: 294 (1892), type locs. Mts. Tamalpais, Diablo, and Hamilton. Var. DEPRESSA Jepson. *Montia parviflora* var. *depressa* Rob. in Gray, Syn. Fl. 1^1: 274 (1897). *Claytonia parviflora* var. *depressa* Gray, Proc. Am. Acad. 22: 281 (1887), type loc. "British Columbia to Oregon and adjacent Idaho." *Montia depressa* Suksd. Deutsche Bot. Monats. 16: 221 (1898). *M. rubra* Howell, Erythea, 1: 38 (1893), type loc. Ore. and Wash. *Limnia rubra* Heller, Muhl. 6: 84 (1910).

8. **M. gypsophiloides** Howell. (Fig. 94.) Stems slender, erect or ascending, 2 to 9 inches high; herbage very pale and glaucous; basal leaves linear or filiform, the flowering stems 2 to several times as long; cauline pair ovate to linear-lanceolate, partially united on one side; raceme slender, elongated (half the height of the plant or more), the filiform pedicels becoming 2 to 8 lines long, spreading and often a little geniculate at the middle; flowers for their

size showy and most delicately beautiful; petals pink, cuneate-obovate, retuse, 3 to 3½ lines long, about 3 times as long as the sepals.

Open summits and northward slopes or in moist thickets. Central Coast Ranges from the Mt. Hamilton Range north to Sonoma Co. Mar. to early May.

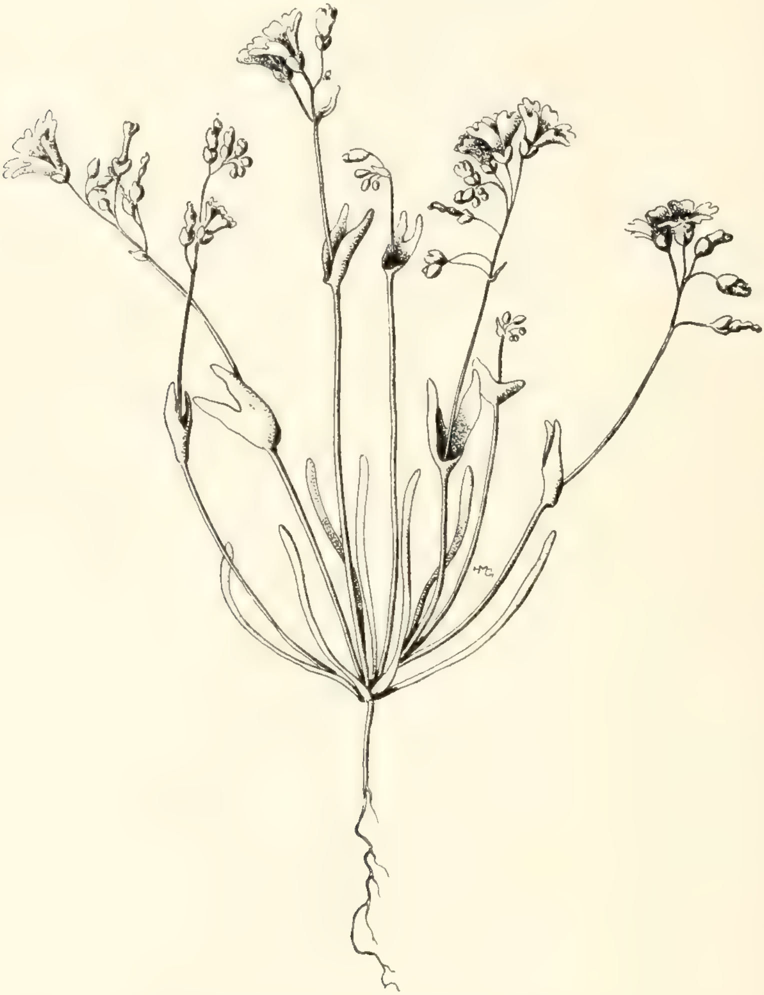

Fig. 94. MONTIA GYPSOPHILOIDES Howell, x 1.

Locs.—Mt. Hamilton, *Jepson* 4223; Mt. Day, Santa Clara Co., ***R. J. Smith;*** Mt. Diablo, *C. F. Baker* 2817; Briones Hills, *Chandler* 588; Berkeley Hills, *Tracy* 1355; Mt. Tamalpais, *Jepson* 3111; Ft. Ross, *Heller;* Happy Valley, Sonoma Co., *M. S. Baker* 721; St. Helena and Calistoga, *Jepson;* Healdsburg, *Alice King.*

Refs.—MONTIA GYPSOPHILOIDES Howell, Erythea, 1: 38 (1893); Jepson, Fl. W. Mid. Cal. 186 (1901). *Claytonia gypsophiloides* F. & M. Ind. Sem. Hort. Petrop. 2: 33 (1835), Sert. Petrop. t. 35, type loc. Ft. Ross, Sonoma Co. (reprint, Erythea, 2: 139).

9. **M. spathulata** Howell. Caespitose, 1 to 6 inches high, the herbage glaucous and very fleshy; leaves narrowly or elongated linear or lanceolate, nearly as long as the flowering stems; cauline leaves linear or lanceolate, nearly dis-

tinct or somewhat connate upon one (rarely on both) sides, 4 to 10 lines long, nearly equaling to ½ as long as the raceme; sepals rather less than 1 line long; petals somewhat quadrangular, retuse or rounded at apex, short-clawed, white or light pink, 2 to 3 lines long.

Common on open gravelly or rocky hill tops (often in vineyards and other cultivated areas). Coast Ranges mostly near the coast; south to Southern California; north to British Columbia. Not known in the Sierra Nevada. Feb.-Mar.

Locs.—Laguna Mt., San Diego Co., *Orcutt* 2046; Los Gatos, *Heller* 7290; San Francisco, *Jepson*; Berkeley Hills, *Tracy* 1355; Mt. Diablo, *C. F. Baker* 2816; Marin Co., *Brewer* 931; St. Helena, *Jepson*; Howell Mt., *Jepson* 514; Kelseyville, *Irwin*; Tehama Co., *Jepson*; Ft. Seward Ranch, *Jepson* 1903; Humboldt Bay, *Tracy* 3128; Yreka, *Butler* 678.

Refs.—MONTIA SPATHULATA Howell, Erythea, 1: 38 (1893); Jepson Fl. W. Mid. Cal. 186 (1893). *Claytonia spathulata* Dougl.; Hook. Fl. Bor. Am. 1: 226, t. 74 (1834), type spms. from the "Northwest Coast," *Menzies*, and n. Rocky Mts., *Douglas*. *Limnia spathulata* Heller, Muhl. 6: 84 (1910).

10. **M. exigua** Jepson n. comb. Similar to M. spathulata but looser and larger (2 to 6 inches high) and less glaucous; basal leaves about equaling the stems, elongated linear, or slightly spatulate, ½ to 1 line broad; leaves of the cauline pair linear, ½ to 1½ inches long, distinct, or slightly connate on one side, usually much exceeding the raceme; petals white, 2 lines long, twice length of sepals.

Throughout California, but mostly towards the interior, the known stations few. At higher elevations than M. spathulata, which is of low hills near the coast. North to British Columbia. Lower California.

Locs.—Yreka, *Butler* 674; Howell Mt., *Jepson* 514; Mt. Diablo, *Brewer* 1082; Yosemite (Zoe, 4: 161); Santa Rosa Peak, *Jepson* 1447; San Diego, *Alderson* 328.

Var. **viridis** Jepson n. comb. Herbage green; cauline leaves lanceolate, nearly distinct.—Mountains of Southern California.

Locs.—Mt. San Antonio (Old Baldy), *Hall* 1245; Onstatt's Valley, Mt. San Jacinto, *Hall* 2218.

Refs.—MONTIA EXIGUA Jepson. *Claytonia exigua* T. & G. Fl. 1: 200 (1838), type spm. from California, *Douglas*. *Montia spathulata* var. *exigua* Rob. in Gray, Syn. Fl. 1^1: 275 (1897). *Claytonia tenuifolia* T. & G. Fl. 1: 201 (1838), type from California, *Douglas*. *C. spathulata* var. *tenuifolia* Gray, Proc. Am. Acad. 22: 282 (1887). Var. VIRIDIS Jepson. *Montia spathulata* var. *viridis* Davidson, Bull. S. Cal. Acad. 5: 61 (1906), type loc. Rock Creek, desert side of Mt. San Antonio, *Hasse & Davidson*.

11. **M. saxosa** Brandegee. Stems numerous, caespitose, forming a dense succulent ball 1 to 2 inches in diameter; basal leaves obovate or spatulate, rounded at apex, 3 to 6 lines long, nearly sessile; cauline leaves a single pair, ovate, obtuse, not connate, 2 to 3 lines long; racemes umbellate, few-flowered, the pedicels equaling or exceeding the short scape-like stems; sepals roundish, 2 lines long, the roseate petals twice as long; capsules 1½ to 2 lines long; seeds foveolate-striate.

Yollo Bolly Range, from North Yollo Bolly south to Snow Mt., about 7000 feet altitude.

Refs.—MONTIA SAXOSA Brandegee; Gray, Syn. Fl. 1^1: 274 (1897). *Claytonia saxosa* Brandegee, Zoe, 4: 150 (1893), type loc. Snow Mt., *Brandegee*. *Montia rosulata* Eastw. Proc. Cal. Acad. ser. 3, Bot. 1: 79 (1897), type loc. near Rock Spring, Mt. Tamalpais; basal leaves 5 to 10 lines long; flowers 1½ to 2 lines across; petals white, oblong-obcordate. *Limnia rosulata* Heller, Muhl. 10: 84 (1910).

12. **M. sibirica** Howell. Stems erect, 9 to 18 inches high; root fibrous and annual with a thick crown, or the crown persistent as a short rootstock; basal leaves ovate or obovate to suborbicular, acuminate or acute, rarely obtuse, 1 to 2 inches long, on petioles 3 to 5 inches long; cauline pair similar, distinct, sessile or short-petioled; raceme very lax, 3 to 7 inches long, bracteate, the

flowers on long (1 to 2½ inches) pedicels; sepals orbicular to ovate, obtuse; petals white with pink veins or pink with rose-purple lines, coarsely notched, 3 to 5 lines long, narrowed at base into a distinct claw.

Swampy places along the coast. Marin Co. to Humboldt Co. and far north to Alaska. Feb.-June.

Locs.—Olema, *Jepson;* Bear Valley, Marin Co., *Davy* 700; Pt. Reyes, *Greene;* Stewarts Pt., *Baker;* Pt. Arena, *Bioletti;* Eureka, *Tracy* 2557; Arcata, *Chesnut & Drew;* near Buck Mt., Humboldt Co., *Tracy* 2860; Redwood Creek, Hupa Road, *Jepson* 1951; Highland Mine, Siskiyou Co., *Butler* 964; Sisson, *Jepson.*

Refs.—MONTIA SIBIRICA Howell, Erythea, 1: 39 (1893). *Claytonia sibirica* L. Sp. Pl. 204 (1753), "Sibiria"; Jepson, Fl. W. Mid. Cal. 186 (1901). Var. *bulbifera* Rob. Syn. Fl. 1^1: 273 (1897). *Claytonia bulbifera* Gray, Proc. Am. Acad. 12: 54 (1876), type loc. Scott Mts., *Greene;* thickened bases of leaves persistent on crown as bulblet scales. *Limnia bulbifera* Heller, Muhl. 6: 83 (1910).

13. **M. heterophylla** Jepson n. comb. Stems 5 to 11 inches high, rising from tuberous rootstocks or cormlets, these sending out slender stolons which produce terminal cormlets, the secondary cormlets promptly producing leaves and flowers; basal leaves narrowly ovate to oblanceolate, acute, ½ to 2 inches long, on long slender petioles; cauline pair similar, subsessile; raceme 5 to 11-flowered; pedicels becoming ¾ to 1 inch long; sepals round-ovate, obtuse or subcordate at base, 2 lines long; petals white, pink-veined, notched, twice as long as the sepals.

Southern Sierra Nevada, 5700 to 7000 feet. Oregon to Alaska. The tubers or fleshy rootstocks each produce only 1 or 2 stems and leaves, whereas in M. sibirica the numerous leaves and stems form by their bases a thick crown on the slender or fibrous taproots.

Locs.—Freeman Creek, Tulare Co., *Jepson* 4884; Pine Ridge, Fresno Co., *Hall & Chandler* 304.

Refs.—MONTIA HETEROPHYLLA Jepson. *Claytonia unalaschkensis* var. *heterophylla* Nutt.; T. & G. Fl. 1: 199 (1838), type loc. Oregon, *Nuttall. Montia sibirica* var. *heterophylla* Rob. in Gray, Syn. Fl. 1^1: 273 (1897).

14. **M. asarifolia** Howell. Stems erect, naked save for one cauline pair of leaves, 7 to 12 inches high, arising from a horizontal rootstock; basal leaves round-ovate, obtuse to acutish, ¾ to 1¾ inches long, on petioles 3 to 6 inches long; cauline pair similar, obtuse or often more acute; raceme loosely 3 to 8-flowered, the pedicels ½ to 1¼ inches long; sepals orbicular, truncatish, 1½ to 2 lines long; petals white, merely retuse, 3 to 5 lines long.

High mountains, northern California. North to Alaska, east to northern Rocky Mts.

Locs.—Trinity Summit, *Manning;* w. Siskiyou Co., *Butler* 65 (Marble Valley), 1510 (Shackleford Creek).

Refs.—MONTIA ASARIFOLIA Howell, Erythea, 1: 39 (1893). *Claytonia asarifolia* Bong. Mem. Acad. St. Petersb. ser. 6, 2: 137 (1832), type loc. Sitka, Alaska. *Claytonia nevadensis* Brew. & Wats. Bot. Cal. 1: 77 (1876), type loc. northern Sierra Nevada, *Lemmon.*

4. CLAYTONIA Gron.

Low glabrous perennial herbs, the stems and basal leaves from globose deep-seated corms. Stems scape-like, bearing at summit a pair of opposite leaves and between them a several-flowered loose raceme. Flowers opening for more than one day. Sepals 2. Petals 5, distinct and equal. Stamens 5. Ovules few, about 6. Style-branches 3. Capsule 3-valved, 3 to 6-seeded.—Species about 8, North America and Asia. (Dr. John Clayton, American botanist, of the colony of Virginia, who furnished Gronovius the materials for the Flora Virginica; died 1773.)

1. **C. lanceolata** Pursh. Stems 1 to 24 from a corm, erect, 2 to 4 inches high; corm globose, about ½ inch in diameter; basal leaves few or rare, nar-

row, long-petioled; cauline leaves narrowly to oblong-lanceolate, sessile, 1 to 2 inches long; racemes 1, or sometimes 2 or 3, sessile or short-peduncled, 5 to 17-flowered, the pedicels bractless except the lowest; petals pink with darker veins, or nearly white, often with a yellow dot at base, emarginate or obtuse, 3 to 4 lines long; pedicels recurved in fruit.

Montane, 4500 to 7000 feet, northern Sierra Nevada north to Modoc Co., thence west to Humboldt Co. North to British Columbia and east to Utah.

Locs.—Cisco, *Kellogg;* Mt. Lassen, *Jepson* 4089; Susanville, *Austin & Bruce;* Forestdale, Modoc Co., *Baker;* Shackleford Cañon, w. Siskiyou Co., *Chandler;* Marble Mt., *Jepson* 2836 (sometimes with 6 petals and 6 stamens; one flower had 8 petals, 2 of them ⅔ united, stamens 6); Trinity Summit, *Jepson* 2104.

Refs.—CLAYTONIA LANCEOLATA Pursh, Fl. 1: 175 (1814), type loc. Bitterroot Mts., Idaho, *Lewis;* Gray, Am. Jour. Sci. ser. 2, 33: 407 (1862). Var. *sessilifolia* Nelson, Bull. Torr. Club, 27: 259 (1900). *C. caroliniana* var. *sessilifolia* Torr.; Brew. & Wats. Bot. Cal. 1: 76 (1876).

5. LEWISIA Pursh.

Acaulescent fleshy perennials with very thick farinaceous roots bearing rosulate clusters of leaves and 1 to many-flowered scapes. Flowers often large and handsome. Sepals 2 to 8, herbaceous, persistent. Petals 5 to 16, varying from white to red. Stamens 5 to numerous. Style-branches 3 to 8, filiform, stigmatic their whole length. Capsule circumscissile near the base, the upper deciduous part more or less valvate-cleft from the base. Seeds several to many.—Species 11, western North America. (In honor of Capt. Lewis of the Lewis & Clark expedition across the continent, who collected the type species.)

The flower-parts in the species of this genus are very variable in number even on the same plant, more so than in any other genus of this family. The flower diagnoses which follow are chiefly based on notes made in the field, many counts having been made of flower parts on individual plants.

Sepals 2; flowers medium; scapes commonly bearing a cyme or panicle.—Subgenus OREOBROMA.
Stems from a small globose corm; leaves 2 or 3 below the inflorescence....1. *L. triphylla.*
Stems scape-like, leafless.
Scapes 1 to 4-flowered, with a pair of small bract-like leaves; root thick, fusiform to globose.
Leaves exceeding scapes; scapes 1 to 3-flowered.
Bracts ovate, borne above the middle of scapes; sepals ovate, obtuse, glandular-denticulate ....2. *L. pygmaea.*
Bracts linear, borne at surface of ground; sepals ovate, acute, entire, not glandular ....3. *L. nevadensis.*
Leaves shorter than the 2 to 4-flowered scapes; bracts and sepals denticulate, not glandular ....4. *L. oppositifolia.*
Scapes bearing a panicle of numerous flowers; leaves in a tuft on the caudex crowning a thick fleshy root; bracts and sepals ciliate-glandular.
Flowers 5 to 7 lines long; leaves narrowly linear.................5. *L. leana.*
Flowers 2½ to 3 lines long; leaves spatulate-obovate..........6. *L. cotyledon.*
Sepals and sepal like bracts 4 to 8; flowers large; scapes 1 flowered.—Subgenus EULEWISIA.
Scapes jointed just beneath the calyx, with two bracts at the joint which resemble the 2 sepals.
Sepals glandular-denticulate ....7. *L. kelloggii.*
Sepals not glandular-denticulate.................................8. *L. brachycalyx.*
Scapes jointed above the middle, with an involucre of 5 to 7 scarious subulate bracts; sepals 6 to 8...9. *L. rediviva.*

1. **L. triphylla** Rob. (Fig. 95a.) Scape half underground, arising from a globose tuber about the size of a pea, 1 to 2 inches high and bearing a simple or compound umbellate raceme subtended by 3 or 2 narrowly linear leaves; umbel 3 to 14 (or 27) -flowered, or the flowers only 2 or 1; petals white, 5 to 7 or 10, subequal or unequal, 1¾ to 2 lines long; stamens 4 or 5; styles 5 (4 or 3).

Moist slopes or swales, in granite sand or fine gravel: Sierra Nevada and North Coast Ranges, 6000 to 9600 feet. North to Washington and Idaho.

Locs.—Middle Tule River, *Purpus* 1806; Alta Mdws., *K. Brandegee*; Mt. Silliman, *Jepson* 756; Pine Ridge, Fresno Co., *Hall & Chandler* 124; Yosemite Park, *Jepson* 4370 (Eagle Peak), 3231 (Vogelsang Pass), 3329 (Mt. Lyell, sepals not glandular), 3381 (Rodgers Creek); Lake Eleanor, *Chesnut & Drew*; Donner Lake, *Davy* 3203; Lassen Peak, *Jepson* 4098; Medicine Lake, *M. S. Baker*; ridge above Cudahay Valley, w. Siskiyou, *Jepson* 2853a; South Yollo Bolly, *Jepson*.

Refs.—LEWISIA TRIPHYLLA Rob. in Gray, Syn. Fl. 1^1: 269 (1897). *Claytonia triphylla* Wats. Proc. Am. Acad. 10: 345 (1875), type loc. northern Sierra Nevada. *Oreobroma triphylla* Howell, Erythea, 1: 33 (1893).

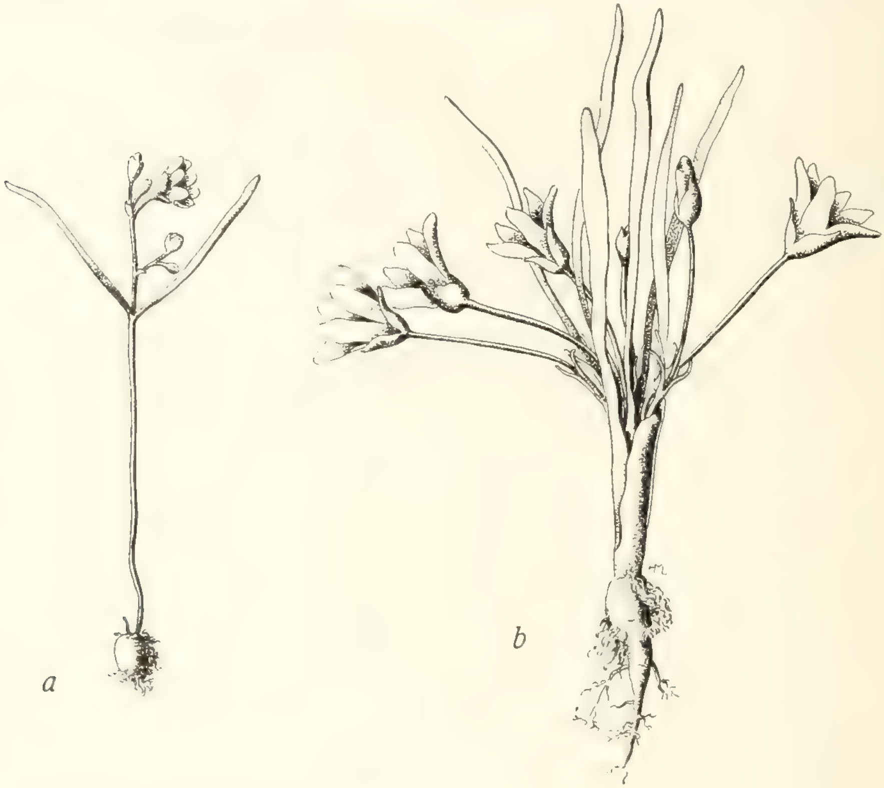

Fig. 95. *a*, LEWISIA TRIPHYLLA Rob. The leaves are nearly as often two as three. *b*, LEWISIA NEVADENSIS Rob. x 1.

2. **L. pygmaea** Rob. Scapes several to many, 1 to 2 inches high, these and the leaves from a fleshy root; root elongated-fusiform, 3 to 6 lines thick; leaves linear, slightly exceeding the flowers; scapes one-flowered with a pair of ovate bracts above the middle, or umbellately 2-flowered and the pedicels subtended by the bracts; sepals ovate, obtuse, glandular-denticulate; petals white, 6 to 9, subequal or unequal, often notched on one side or at apex, 3 lines long; stamens 5 to 8; styles 3 to 5; scapes soon retrocurved.

Sierra Nevada, 8000 to 12,200 feet. North to Washington and east to the Rocky Mts.

Locs.—Mt. Guyot, Kern River, *Mary Haskell*; Mineral King, *T. Brandegee*; Mt. Silliman, *K. Brandegee*; Mt. Lyell, *Jepson* 3329; Mt. Dana, *Chesnut & Drew*; Bierstadt Peak, *Davy* 3191.

Refs.—LEWISIA PYGMAEA Rob. in Gray, Syn. Fl. 1^1: 268 (1897). *Talinum pygmaeum* Gray, Am. Jour. Sci. ser. 2, 33: 407 (1862), type loc. South Clear Creek, Colo., *Parry*. *Calandrinia pygmaea* Gray; Brew. & Wats. Bot. Cal. 1: 75 (1876). *Oreobroma pygmaea* Howell, Erythea, 1: 33 (1893).

OREOBROMA LONGIPETALA Piper, Contrib. U. S. Nat. Herb. 16: 207 (1913). Scapes simple, or bearing 2 or 3 erect branches, much exceeding the leaves; petals 6 to 9 lines long.—"Sierra Nevada," *Lemmon*. Ex. char.

3. **L. nevadensis** Rob. (Fig. 95b.) Scapes several to many, ½ to 4 inches high, naked save for a pair of bracts near the middle—that is, near the surface of the ground; scapes and leaves arising from a fleshy carrot-shaped or sometimes globose root; bracts linear, opposite, often a little connate by their scarious bases; leaves narrowly linear or slightly broadened upward, 1 to 2½ inches long, 1 to 2 lines broad, exceeding the scapes; flowers white, solitary and terminal on the stems; sepals ovate, acute; petals 6 to 8 (rarely 5), 6 to 7 lines long; stamens 6 to 11; styles 5 (3, 4 or 6); scapes retrocurving in fruit.

Granite sand, Sierra Nevada, 7000 to 11,000 feet. Not known in Southern California. North to Washington and east to Utah. June.

Locs.—Middle Tule River, *Purpus* 1805; Ramshaw Mdws., Kern Peak, *Jepson* 4962; Kaweah Peak, *Jepson* 5000; Shaver, *Hall & Chandler* 303½; Yosemite Park, *Jepson* 4565 (Stubblefield Cañon), 3381 (Rodgers Creek); Donner Lake, *Davy* 3183; Gold Lake, Sierra Co., *Hall & Babcock* 4505; Forestdale, Modoc Co., *M. S. Baker;* Benton Mdws., Modoc Co., *Austin & Bruce*.

Refs.—LEWISIA NEVADENSIS Rob. in Gray, Syn. Fl. 1^1: 268 (1897). *Calandrinia nevadensis* Gray, Proc. Am. Acad. 8: 623 (1873), type spms. from the Wahsatch, East Humboldt and Sierra Nevada mountains. *Oreobroma nevadensis* Howell, Erythea, 1: 33 (1893).

4. **L. oppositifolia** Rob. Scapes 1 to 3, erect or ascending, 6 to 8 inches high, these and the leaves from a fleshy-fusiform root, or 1 or 2 pairs of leaves on the lower part of the scape; leaves linear-oblanceolate or linear, 1 to 3 inches long; scapes naked or with 1 or 2 lanceolate bracts, bearing 2 to 4 umbellately disposed flowers on long (½ to 1½ inches) pedicels; sepals 2 to 3 lines long, roundish, denticulate at the truncate or obtuse apex but glandless; petals white or pink, 6 to 7 lines long; stamens about 12.

Del Norte Co., California, to Josephine Co., Oregon.

Locs.—Smith River, acc. *Watson;* Waldo, Ore., (Erythea, 1: 32); Kerby to Josephine Creek, Ore., *M. S. Baker.*

Refs.—LEWISIA OPPOSITIFOLIA Rob. in Gray, Syn. Fl. 1^1: 268 (1897). *Calandrinia oppositifolia* Wats. Proc. Am. Acad. 20: 355 (1885), type locs. Waldo, Ore., and near Smith River, Del Norte Co., Cal., *Howell*. *Oreobroma oppositifolia* Howell, Erythea, 1: 32 (1893).

5. **L. leana** Rob. Scapes few, 5 to 9 inches high, rising from a thick fleshy caudex, bearing a panicle of numerous flowers and a few scattered small bracts; leaves in a dense tuft crowning the caudex, narrowly linear, acute, more or less terete, 1 to 2½ inches long and 1 to 2½ lines wide; sepals ovate or roundish, 1 line long, fimbriate with reddish gland-tipped teeth; petals 5 to 7, red, 2½ to 3 lines long; stamens 5 (or 4); scapes disarticulating from the caudex soon after flowering.

Siskiyou and Salmon mountains, and southern Sierra Nevada, 6000 to 9000 feet. Oregon.

Locs.—Fresno Co. (Woodchuck Peak, *Eisen*, Dinkey Creek, *Hall & Chandler* 398); Hennessey Trail, Mariposa Co., *Congdon;* Castle Lake near Mt. Shasta, *Lemmon;* Marble Mt., *Chandler* 1609; Shackleford Creek, *Butler* 1687; Twin Lakes, Cañon Creek, Trinity Co., *Eastwood.*

Refs.—LEWISIA LEANA Rob. in Gray, Syn. Fl. 1^1: 269 (1897). *Calandrinia leana* Porter, Bot. Gaz. 1: 49 (1876), type loc. Siskiyou Mts., *L. W. Lee*. *Oreobroma leana* Howell, Erythea, 1: 31 (1893).

6. **L. cotyledon** Rob. (Fig. 96.) Scapes several from the leafy crown of a thick caudex, 4 to 10 inches high, bearing at summit a panicle and below the

panicle two pairs of bracts; bracts ovate, acute; leaves in a dense rosulate tuft, spatulate-obovate or -orbicular, $1\frac{1}{2}$ to 3 inches long; sepals roundish, very obtuse, glandular-denticulate, 2 to 3 lines long; petals 7 to 10, obovate or oblanceolate, white, strongly pink-veined along the middle, 5 to 7 lines long; stamens 6 to 9; petals 8 or 9; filaments dilated below and connate into a sheath surrounding the ovary; style-branches 3 (or 2).

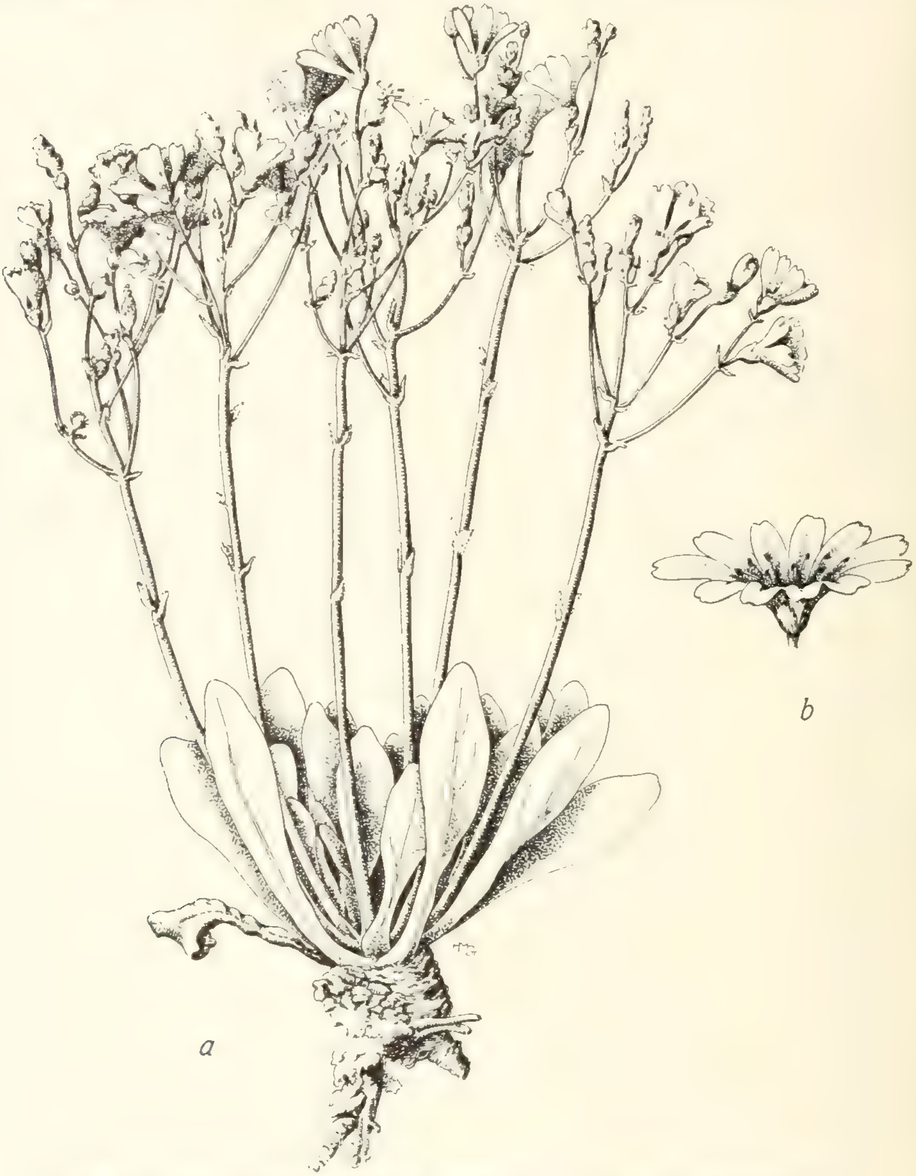

Fig. 96. LEWISIA COTYLEDON Rob. *a*, plant, x ½; *b*, fully opened flower, x 1.

Western Siskiyou Co. and northern Trinity Co. A most attractive species. July.

Locs.—Preston Peak, *Howell*, June, 1884; Shackleford Cañon, *Jepson* 2817; Log Lake, *Butler* 1527; Highland Mine, *Butler* 960; Cañon Creek, Trinity Co., *Eastwood*.

The two following varieties occur very near the California boundary. Var. **purdyi** Jepson n. var. Leaves orbicular-oblanceolate, very short; bracts elliptic, obtuse. (Folia orbiculata-oblanceolata brevissima; bracteae ellipticae obtusae.)—Kerby, Josephine Co., Ore., acc. *Purdy*. Var. **howellii** Jepson n. comb. Leaves with crisped narrowly membranous edges.—Southwestern Oregon (Josephine Co., *Howell*, east to Grizzly Butte, Jackson Co., acc. *Purdy*).

Refs.—LEWISIA COTYLEDON Rob. in Gray, Syn. Fl. 1^1: 268 (1897). *Calandrinia cotyledon* Wats. Proc. Am. Acad. 20: 355 (1885), type loc. head of Illinois River, Siskiyou Mts., *Howell*. *Oreobroma cotyledon* Howell, Erythea, 1: 32 (1893). Var. PURDYI Jepson. Lewisia purdyi Jepson of the gardens. Var. HOWELLII Jepson. *Lewisia howellii* Rob. l. c. *Calandrinia howellii* Wats. l. c. 23: 262 (1887), type loc. Deer Creek Mts., Josephine Co., Ore., *Howell*.

7. **L. kelloggii** K. Brandegee. Flowers and leaves densely crowded on the crown of a thick fleshy taproot; scapes very short, 3 to 7 lines long, jointed at the base, these and the petioles with loose transversely wrinkled whitish epidermis; leaves spatulate or obovate, obtuse, mostly notched at apex, 3 to 5 lines long, drawn down to a petiole as long or twice as long; sepals 4 (or 6), oblong or oblong-lanceolate, acute, minutely glandular-toothed, 3 to 4 lines long; petals 8 to 11, white, 2 to 3 times as long as the sepals; stamens 15 to 26 (or as few as "12"); style-branches 5 or "4"; capsule thin-walled, separating in a circumscissile manner from the receptacle at base, then splitting upwards into 2 (or "4 or 5") valves.

Northern Sierra Nevada, 4500 to 6000 feet, in sand on granite ridges or domes. On El Capitan, and doubtless generally, the plants barely push up through the granite sand, and the flowers open directly out on the surface of the sand, the cluster of rotately-spreading corollas forming a rosette which is very beautiful. Counts of flower parts were made by us on El Capitan in 1911. The sepals varied from 4 to 6, the petals from 7 to 11, and the stamens from 16 to 26. The style-branches were uniformly 5. The flowers do not disjoint from the plant in drying.

Locs.—American Valley, *R. M. Austin*; Big Mdws., *R. M. Austin*; Cisco, *Kellogg*; crown of El Capitan, Yosemite Valley, *Jepson* 4357.

Ref.—LEWISIA KELLOGGII K. Brandegee, Proc. Cal. Acad. ser. 2, 4: 88, pl. 4 (1893), type loc. Cisco, *Kellogg*.

8. **L. brachycalyx** Engelm. Scapes rather short, rising from a thickened caudex, surpassed by the moderately fleshy leaves; leaves in a spreading rosette, spatulate or oblanceolate, 1 to 4 inches long; sepals 4, ovate, acute, entire, 3 to 4 lines long; petals 5 to 9, white, ½ to 1 inch long; stamens 10 to 15; style-branches 5 to 7.

Wet meadows, San Bernardino Mts., 6700 feet. Utah, Arizona and New Mexico.

Loc.—Bear Valley, San Bernardino Mts., *Parish* 2337, the only known station in Cal.

Refs.—LEWISIA BRACHYCALYX Engelm.; Gray, Proc. Am. Acad. 7: 400 (1868), type spms. from Utah, New Mex. & Ariz. *Oreobroma brachycalyx* Howell, Erythea, 1: 31 (1893).

9. **L. rediviva** Pursh. BITTER ROOT. Scapes from a thick caudex crowning a stout root, ¾ to 2 inches high, jointed near the middle and bearing an involucral whorl of 5 or 7 scarious subulate bracts; leaves linear, thick, 1 inch long; sepals 6 to 8; petals 13 to 15 (or "16"), pink, bright rose or white, ¾ to 1 inch long, spreading rotately; stamens 40 to 47; filaments united at base; style-branches 6 to 8.

California, north to British Columbia and east to the Rocky Mts. Flowers disjointing readily at the middle of the scapes on drying. Apr.

Locs.—Coast Ranges: Mt. Pinos, *Hall* 6545; Santa Lucia Mts.; Pinnacles west of Hollister, acc. *Peters*; Mt. Hamilton (Erythea, 1: 85); Mt. Diablo, *Jepson* 2640; Mt. Tamalpais, *M. L. Hutchinson*; near Sonoma, *Brewer* 976; Big Cañon, Howell Mt., *F. G. Hills* in litt.; Kelseyville, *Irwin*; Big Valley, Modoc Co., *M. S. Baker*. Southern California: Lytle Cañon, San Gabriel Mts., *Hall* 1461; Bear Valley, San Bernardino Mts. (Zoe, 4: 162).

Refs.—LEWISIA REDIVIVA Pursh, Fl. 2: 368 (1814), type loc. Lou Lou fork Bitterroot River, Mont., *Lewis;* Hook. f. Bot. Mag. t. 5395 (1863); Kelsey, Zoe, 3: 109 (1892); Jepson, Fl. W. Mid. Cal. 185 (1901); Piper, Contrib. U. S. Nat. Herb. 11: 246 (1906); Heller, Muhl. 5: 15 (1909). *L. alba* Kell. Proc. Cal. Acad. 2: 115, fig. 36 (1861). Var. YOSEMITANA K. Brandegee, Proc. Cal. Acad. ser. 2, 4: 89 (1894), type loc. "somewhere about Yosemite Valley, Mrs. W. F. Dodd." Peduncles jointed below the flower and crowned by 3 scarious bracts; sepals 2, broad, emarginate; petals 5.—Ex. char.

6. **PORTULACA** L.

Fleshy herbs, ours annuals, with alternate leaves and yellow flowers. Calyx 2-cleft, the tube adnate to the ovary below. Petals 5 (rarely 6), inserted with the stamens on the calyx. Stamens 7 to 20. Style mostly 3 to 8-parted. Capsule globose, opening transversely, the upper part coming off like a lid. Seeds many.—Species about 20, mainly tropical and subtropical regions, all continents. (Old Latin name.)

1. **P. oleracea** L. COMMON PURSLANE. Stems 4 to 8 inches long; herbage glabrous; leaves cuneate or obovate; flowers sessile, opening only in sunshine; petals notched or 2-lobed.

Frequent in low lands throughout the state. Introduced from tropical America. June-Oct.

Locs.—Yreka, *Butler* 1061; Hy-am-pum, *Chesnut & Drew;* Kelseyville, *Jepson;* Berkeley, *Alice King;* Lathrop, *Harriet Walker;* Porterville, acc. *Hilgard;* Los Angeles (Erythea, 1: 58).
Refs.—PORTULACA OLERACEA L. Sp. Pl. 445 (1753); Jepson, Fl. W. Mid. Cal. 184 (1901).

P. RETUSA Engelm. in Gray, Pl. Lindh. 2: 154 (1850), type loc. western Texas, *Lindheimer.* Ascending; leaves often retuse; petals small or minute; seeds echinate.—Texas to Arizona. To be expected on the California side of the Colorado River.

CARYOPHYLLACEAE. PINK FAMILY.

Herbs of inert properties, with commonly swollen nodes, simple and entire leaves always opposite, and regular perfect flowers. Calyx persistent. Corolla white, red or pink. Sepals and petals 5 (or 4), the stamens as many and alternate with the petals, or twice as many, rarely fewer. Ovary superior, 1-celled (imperfectly 3-celled in some Silenae), with 1 to 5 styles and 1 to many ovules on a free central placenta. Fruit a few to many-seeded 1-celled capsule dehiscent at the summit by short valves or teeth (these as many or twice as many as the carpels), or 1-seeded and indehiscent, thus becoming an achene or utricle. Embryo commonly curved around the periphery of the seed, the endosperm occupying the center. Species about 1300 in 76 genera, mostly temperate regions but occurring in all zones and all continents.

Bibliog.—Rohrbach, Paul, Monog. Gatt. Silene, 1-250, t. 1-2 (1868). Watson, S., Western Species of Silene (Proc. Am. Acad. 10: 340-44,—1875). Hollick & Britton, Cerastium arvense L. and its N. Am. Varieties (Bull. Torr. Club, 14: 45-51, pls. 63-65,—1887). Britton, N. L., N. Am. Species of Tissa (Bull. Torr. Club, 16: 125 129,—1889). Robinson, B. L., The N. Am. Sileneae and Polycarpeae (Proc. Am. Acad. 28: 124-155,—1893); The N. Am. Alsineae (l. c. 29: 273-313,—1894). Williams, F. N., On the Genus Arenaria (Bull. Herb. Boiss. 3: 593-603, —1895); Rev. of Arenaria (Jour. Linn. Soc. Bot. 33: 326-437,—1898); Rev. of Silene (l. c. 32: 1-196,—1896); Primary Subdivisions in the Genus Silene (Jour. Bot. 32: 10-13,—1894); On Primary Characters in Cerastium (l. c. 36: 8-10,—1898); An Account of Velezia (l. c. 37: 25-34,—1899). Fernald, M. L., & Wiegand, K. M., Some Northeastern Species of Spergularia (Rhod. 12: 157-163,—1910). Fernald, M. L., The Am. variations of Stellaria borealis (Rhod. 16: 144-151,—1914).

A. Sepals distinct or united only at base.

Petals spreading, without claws or appendages, or in a few species wanting; ovary not stipitate; fruit a capsule; low herbs.
  Styles 3 to 5, distinct; petals present, mostly conspicuous (for the choripetalous genera). Tribe ALSINEAE.
    Stipules none.

Petals bifid or 2-divided, rarely none; styles 3, 4 or 5, when of the same number as the sepals opposite them.
Capsule cylindric, usually conspicuously elongated and often curved; styles commonly 5, opposite the sepals..................1. CERASTIUM.
Capsule ovoid or oblong, relatively short; styles 3 (or 4)......2. STELLARIA.
Petals entire or merely notched, rarely none.
Styles as many as the sepals and alternate with them..........3. SAGINA.
Styles fewer than the sepals...............................4. ARENARIA.
Stipules present, scarious (setaceous in no. 8); petals entire.
Styles 3; leaves opposite ....5. SPERGULARIA.
Styles 5; leaves apparently whorled..........................6. SPERGULA.
Style 1, 3-cleft or -toothed; petals minute or none.—Tribe POLYCARPEAE.
Leaves opposite or in 4s, oblong or obovate.....................7. POLYCARPON.
Leaves opposite, subulate, cuspidate..............................8. LOEFLINGIA.
Petals none or represented by mere filament-like organs; style 1, 2-cleft or -parted, rarely 3-cleft, or styles 2; fruit a utricle or achene; very small or prostrate herbs.—Tribe ILLECEBREAE.
Sepals distinct or nearly so; stipules present.
Annual; stipules and flowers minute..............................9. HERNIARIA.
Perennial; stipules conspicuous, silvery-scarious.
Leaves subulate; sepals very unequal, armed with a divergent spine........... 10. PENTACAENA.
Leaves oblanceolate; sepals equal, cuspidate..................11. PARONYCHIA.
Sepals united below into a short tube.
Stipules present.
Staminodes without glands; annual......................12. ACHYRONYCHIA.
Staminodes with glands; perennial........................13. EREMOLITHIA.
Stipules none; low annual......................................14. SCLERANTHUS.

B. Sepals united into a tubular calyx.

Petals with conspicuous claws, these with the stamens and ovary frequently raised above the base of the calyx on a stipe; styles distinct; fruit a capsule; stipules none; mostly erect and often tall herbs.—Tribe SILENEAE.
Calyx teeth much shorter than the tube.
Styles 2; capsule opening by 4 short teeth.
Flowers showy.
Calyx ovate, with 5 prominent angles; petals not appendaged..15. VACCARIA.
Calyx tubular, not angled; petals with scales...............16. SAPONARIA.
Flowers minute; calyx narrow-cylindric, about 15-ribbed........17. VELEZIA.
Styles 3; capsule opening by 3 or 6 teeth or valves; claw of the petals commonly bearing scales or appendages at its junction with the blade....18. SILENE.
Calyx teeth longer than the tube; styles 5; capsule opening by 5 teeth...19. AGROSTEMMA.

1. CERASTIUM L. MOUSE-EAR CHICKWEED.

Pubescent herbs with white flowers. Cymes dichotomous with herbaceous or scarious bracts. Sepals 5. Petals 5, retuse or bifid. Stamens 10 or 5. Styles 5. Capsule elongated, cylindric, often curved, usually much exceeding the calyx, dehiscent at apex by 10 teeth, these erect or spreading. Seeds rough, more or less flattened.—Species about 100, all continents except Australia. (Greek keras, a horn, in allusion to the elongated curved capsules.)

Petals shorter than or about equaling the sepals.
Annual; pedicels not longer than the flowers...............................1. *C. viscosum.*
Perennial; pedicels longer than the flowers............................2. *C. vulgatum.*
Petals twice as long as sepals; perennial..3. *C. arvense.*

1. **C. viscosum** L. MOUSE-EAR CHICKWEED. Erect, 3 to 10 (or 15) inches high, pilose-hirsute and somewhat glandular, especially on the calyx; leaves ovate to elliptic-oblong, sessile, slightly connate, 7 to 12 lines long; pedicels not longer than the sepals; petals equaling or distinctly shorter than the sepals, oblong, bifid at apex, 2 lines long; stamens 10, one or more with reduced or abortive anthers, or sometimes only 5 with anthers, the other 5 represented by mere scale-like filaments; capsule tubular, 4 lines long, about twice as long

as the calyx, the slightly curved apex contracted; seeds numerous, minutely muriculate.

Common in fields and by roadsides. Mar.-Apr. Naturalized from Europe.

Refs.—Cerastium viscosum L. Sp. Pl. 437 (1753), type European; Jepson, Fl. W. Mid. Cal. 166 (1901).

2. **C. vulgatum** L. Biennial or perennial; stems erect or ascending, 9 to 13 inches high; herbage hairy-pubescent throughout and somewhat viscid; lower leaves spatulate-oblong, upper oblong, 5 to 10 lines long; flowers loosely cymose, the pedicels as long as or at length exceeding the calyx; bracts scarious-margined; sepals 2 to 2½ lines long, about as long as the 2-cleft petals; capsule curved upward, 2 to 3 times as long as the calyx.

Sparingly naturalized from Europe.

Locs.—Plumas Co. (acc. Wats. Bot. Cal. 2: 434); Eureka, *Tracy* 2569 in 1907; Berkeley, in lawns; Los Angeles, in lawns (Davidson, Pl. L. A. 4).

Refs.—Cerastium vulgatum L. Sp. Pl. ed. 2, 627 (1762), type European. *C. triviale* Link, Enum. Hort. Ber. 1: 433 (1821).

3. **C. arvense** L. Field Chickweed. Stems from running rootstocks, several from a decumbent very leafy and often matted base, nearly naked above, 5 to 9 inches high; herbage pubescent and often glandular, the pedicels and calyx glandular-pubescent; leaves linear, acute, the upper 1 to 1½ inches long, the lowermost often but half as long; cyme contracted, bearing 1 to 6 flowers; sepals 1½ to 2½ lines long, scarious-margined; petals usually twice as long as the calyx, obcordate, deeply notched; capsule scarcely exceeding the calyx, pendulous on the curved end of the pedicel.

Sierra Nevada and in the Coast Ranges as far south as San Francisco. North America, Europe.

Locs.—Coast Ranges: Mission Hills, San Francisco, *Chesnut;* Sausalito, *Chesnut & Drew;* Cazadero, *Davy* 1664; Ft. Bragg, *Margaret Armstrong;* Hupa, *Mary H. Manning.* Sierra Nevada: Vernal Fall, Yosemite, *Jepson* 3138.

Var. **maximum** Holl. & Britt. Stout, tall, 1 to 2 feet high; leaves elongated; cyme ample, spreading, 10 to 18-flowered; capsule equaling to nearly twice the length of the calyx.—Marin Co. north to Humboldt Co.

Locs.—Hupa, *Chandler* 1384; Eureka, *Tracy* 2515; Eel River, Humboldt Co., *Bolander* 6520; Harris, Humboldt Co., *Jepson* 1883; Noyo, *Bolander* 4723.

Refs.—Cerastium arvense L. Sp. Pl. 438 (1753), type European. Var. maximum Holl. & Britt. Bull. Torr. Club, 14: 47 (1887), type spms. from northern California coast (Noyo, San Francisco, etc.). *C. maximum* Heller, Muhl. 1: 50 (1904).

C. alpinum L. var. fischerianum T. & G. Fl. 1: 188 (1838). *C. fischerianum* Ser.; DC. Prod. 1: 419 (1824), type loc. Kamchatka. Leaves rather thick, elliptic- or oval-lanceolate; approaches C. arvense var. maximum very closely.—Humboldt Co. (acc. Gray, Syn. Fl. 1^1: 231).

2. STELLARIA L. Chickweed.

Low slender mostly glabrous herbs, loving moist ground or shaded habitat. Flowers white, small, axillary and solitary, or terminal and cymose. Sepals 5, acute or acuminate. Petals 5, parted almost to the base into narrow segments. Stamens 3 to 10. Styles 3 or 4. Capsule ovoid or oblong, relatively shorter than in Cerastium, dehiscent to below the middle into as many or twice as many valves as there are styles.—Species about 100, all lands. (Latin stella, a star, the flowers star-shaped.)

A. Annual; lower leaves ovate, petioled.

Bracts foliaceous; stems procumbent, weak..............................1. *S. media.*
Bracts scarious; stems filiform, erect..2. *S. nitens.*

B. Perennial; leaves ovate, lanceolate, or linear, all sessile or nearly so.

Petals deeply 2-parted; herbage not glandular.
    Bracts small and scarious.
        Petals minute or none; flowers in umbels.........................3. *S. umbellata.*

Petals longer than the sepals; flowers irregularly cymose, the cymes terminal, often reduced to a single long-pediceled flower..................4. *S. longipes.*
Bracts foliaceous.
Leaves shorter than internodes; petals shorter than the sepals or none.
Flowers cymose; leaves mostly lanceolate........................5. *S. borealis.*
Flowers solitary in the axils; leaves ovate.....................6. *S. crispa.*
Leaves longer than internodes; petals equaling or slightly exceeding sepals; seashore species ....7. *S. littoralis.*
Petals merely retuse or bifid, exceeding the calyx; herbage glandular-pubescent...........
8. *S. jamesiana.*

1. **S. media** Cyr. COMMON CHICKWEED. Slightly succulent, with weak procumbent stems, rooting at the lower nodes; lower leaves ovate, acute, rather abruptly contracted into slender petioles, the upper narrower, sessile; floral bracts foliaceous; pedicels slender, deflexed in fruit; petals shorter than the pubescent sepals; stamens 3, 5 or 10; capsule ovoid, slightly exceeding the calyx.

Introduced from Europe. Common weed along fence lines and ditches and shaded half-waste places generally. Feb.-May. Stems with a pubescent line, and petioles of lower leaves hairy.

Refs.—STELLARIA MEDIA Cyr. Char. Comm. 36 (1784); Jepson, Fl. W. Mid. Cal. 167 (1901). *Alsine media* L. Sp. Pl. 272 (1753), type European.

2. **S. nitens** Nutt. SHINING CHICKWEED. Stems erect, filiform, branching above, 3 to 7 (or 10) inches high, glabrous or slightly hairy below; leaves linear, acute, sessile, 2 to 7 lines long, or the very lowest ovate, 1 to 3 lines long, abruptly contracted into slender petioles nearly twice as long; inflorescence strict, the pedicels erect, $\frac{3}{4}$ inch long or less, or some of the flowers quite sessile; bracts scarious; sepals scarious-margined, subulate-lanceolate, 2 lines long; petals $\frac{1}{2}$ as long as the sepals, sometimes none; capsule oblong, nearly as long as the calyx.

Grassy hillsides and plains, a somewhat obscure plant. Coast Ranges, Great Valley and Sierra Nevada foothills, south to the hills of Southern California from the coast to the inner ranges. North to British Columbia and east to Utah. Apr.-May.

Locs.—Yreka, *Butler* 1158; Humboldt Bay, *Tracy* 3126; Vaca Mts., *Jepson;* Araquipa Hills, Solano Co., *Jepson* 528; San Jose, *A. E. Bush;* Greenhorn Pass, *Purpus* 5699; San Bernardino, *Parish;* Witch Creek, San Diego Co., *Alderson.*

Refs.—STELLARIA NITENS Nutt.; T. & G. Fl. 1: 185, 675 (1838), type loc. Columbia River plains, *Nuttall;* Jepson, Fl. W. Mid. Cal. 167 (1901). *Alsine nitens* Greene, Man. Bay Reg. 33 (1894).

3. **S. umbellata** Turcz. Stems slender, weak, ascending from a rooting base, 3 to 10 inches high; herbage glabrous; leaves ovate to oblong or those above the base oblong-lanceolate, acute, 4 to 8 lines long; flowers in regular or more or less irregular umbels, the umbels terminal on the stem or forks of the cyme; pedicels $\frac{1}{2}$ to $1\frac{1}{4}$ inches long; sepals $\frac{3}{4}$ to 1 line long; petals minute or none; capsule twice as long as the calyx.

Rare, southern Sierra Nevada, 7000 to 8000 feet. East to the Rocky Mts. Eastern Siberia.

Locs.—Soda Springs, Tuolumne Mdws., *Congdon;* Peregoy's Mdw., near Yosemite (acc. Gray, Bot. Cal. 1: 69); near Mineral King (acc. *Coville*); White Mts. (acc. *Coville*).

Refs.—STELLARIA UMBELLATA Turcz. Bull. Soc. Nat. Mosc. 89 (1838), nomen; 15: 173 (1842), type Siberian. *Alsine baicalensis* Cov. Contrib. U. S. Nat. Herb. 4: 70 (1893).

4. **S. longipes** Goldie. (Fig. 97a, b.) Stems strictly erect, 5 to 12 inches high, from slender running rootstocks; at high altitudes dwarfish and densely matted; herbage glabrous; lower leaves oblong to linear, 3 to 6 lines long, or the upper linear-lanceolate, 6 to 10 lines long; flowers solitary and terminal, or in irregular terminal cymes, the pedicels of variable length ($\frac{1}{4}$ to $1\frac{1}{2}$ inches

long) but commonly strictly erect; calyx 1½ to 2 lines long; petals cleft nearly to the base, equaling or exceeding the sepals; capsule dark or black, exceeding the calyx; seed microscopically and scantily puberulent, nearly smooth.

Common in moist often grassy places in the mountains, 4300 to 8500 feet.

Locs.—Bear Valley, San Bernardino Mts., *Parish* 3346; Mineral King, *G. W. Purdy;* meadows on Volcano Creek, Tulare Co., *Jepson* 4959, 4928; Bubbs Creek, *Jepson* 788; Pine Ridge, Fresno Co., *Hall & Chandler* 170; Yosemite Valley, *Jepson;* Piute Creek, Yosemite Park, *Jepson* 3401; Lundy, Mono Co., *Maud Minthorn;* Deer Park, Placer Co., *C. J. Fox, Jr.;* Little Truckee, *Doten;* Big Mdws., Plumas Co., *R. M. Austin, Jepson* 4054; Ft. Bidwell, *Mary H. Manning* 144; Bear Flat, n.e. Shasta Co., *Hall & Babcock* 4158; Quartz Valley, Siskiyou Co., *Butler* 1463; South Yollo Bolly, *Jepson.*

Var. **laeta** Wats. Herbage glaucous.—Long Mdw., Volcano Creek, *Jepson* 4961. Also far northward.

Refs.—STELLARIA LONGIPES Goldie, Edinb. Phil. Jour. 6: 327 (1822), type loc. near Lake Ontario, Canada. *Alsine longipes* Cov. Contrib. U. S. Nat. Herb. 4: 70 (1893). Var. LAETA Wats. Bibl. Index, 112 (1878). *Stellaria laeta* Rich.; Franklin's 1st Journ. App. 7, ed. 1, 738 (1823), loc. class. "barren grounds from Point Lake to the Arctic Sea."

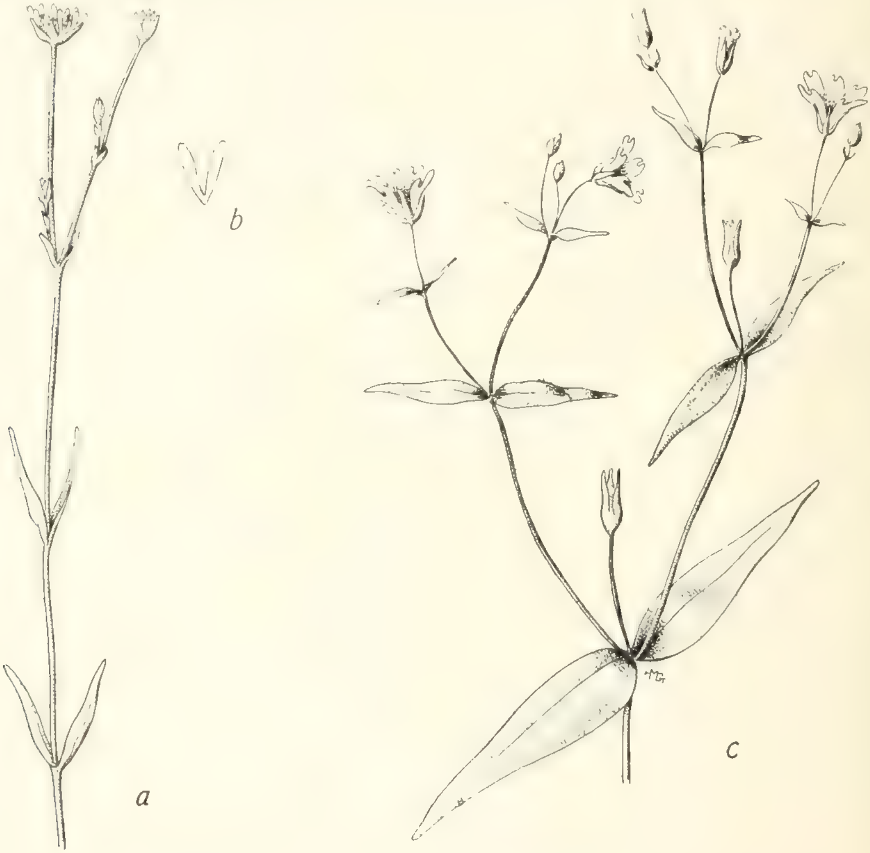

Fig. 97. *a*, STELLARIA LONGIPES Goldie, terminal portion of flowering branch, x 1. *b*, petal, x 2. *c*, STELLARIA JAMESIANA Torr.; terminal portion of flowering branch, x 1.

5. **S. borealis** Bigel. Stems erect or spreading, weak, sparingly branched, 6 to 10 inches long; herbage glabrous; leaves ovate to elliptic-ovate, or acute, 3 to 5 lines long, sometimes a little crisped; flowers in loose terminal leafy

cymes, or often solitary in the lower forks or rarely in the lower leaf axils, on pedicels 2 to 4 or 8 lines long; sepals 1½ to 2 lines long, the petals shorter or wanting; capsule greenish or brownish, oblong, nearly a half longer than the calyx; seed microscopically roughened.

Alpine or subalpine, in wet or cool places, 9000 to 12,000 feet: North Coast Ranges; southern Sierra Nevada; San Bernardino Mts. North to Alaska, thence around the earth. In typical form rare in California, the variety being far more common.

Locs.—South Yollo Bolly, *Jepson*; doubtless Mt. Shasta (cf. Rob. in Gray, Syn. Fl. 1^1: 236, as *S. calycantha*); Medicine Lake, Siskiyou Co., *M. S. Baker* 487; Kaweah Peak, *Jepson* 5003; South Fork Santa Ana River, *Wilder*.

Var. **bongardiana** Fern. Stems 10 to 17 (or 30) inches long; leaves ovate-lanceolate, acuminate, ¾ to 1½ inches long, 1 to 2 (or 3) lines broad; pedicels ¾ to 1½ inches long.—North Coast Ranges, near the coast; Sierra Nevada, 4000 to 6000 or 8500 feet; Mt. San Jacinto. North to Alaska, thence east to New England.

Locs.—North Coast Ranges: Noyo, Mendocino Co., *Bolander* 4718; Ft. Bragg, *Bolander* 6518; Eureka, *Tracy* 795; Van Duzen River Valley, *Tracy* 2884. In the Sierra Nevada the leaves are usually broader (3 to 5, rarely 10, lines broad) and a few on a stem are often crisped, but so are they slightly in coast specimens. Round Mdw., Giant Forest, *Jepson* 683 (sometimes 4-merous with 4 styles); General Grant Grove, *T. Brandegee*; Pine Ridge, Fresno Co., *Hall & Chandler* 151; Yosemite Valley, *Hall*.

Refs.—STELLARIA BOREALIS Bigel. Fl. Bost. ed. 2, 182 (1824), type loc. White Mts., New Hampshire; Fern. Rhod. 16: 144 (1914). *Alsine borealis* Britton, Mem. Torr. Club, 5: 149 (1894). *Stellaria calycantha* Bong. Veg. Sitch. 127 (1832), type loc. Sitka, *Bongard*. Var. BONGARDIANA Fern. Rhod. 16: 151 (1914). *Stellaria longifolia* Bong. l. c. 126, type loc. Sitka, *Bongard*; not Muhl.

6. **S. crispa** C. & S. Stems ascending or reclining, 4 to 15 inches long, simple above the base or sparingly branched; herbage glabrous; leaves rather remote, ovate, abruptly short acuminate or very acute, usually crisped on the edges, 2 to 6 (or 9) lines long; flowers solitary in the axils (at every other node or more scattered), on pedicels 3 to 5 lines long; pedicels erect, or often spreading or deflexed in fruit, about half the length of the internode; calyx 1½ lines long; petals divided, equaling the sepals or shorter, or none; capsule straw-colored, ½ longer than the calyx.

Grassy wet meadows, North Coast Ranges. North to Alaska. May-July.

Locs.—Olema, Marin Co., *Davy* 4343; Hydesville, *Tracy* 2438; Eureka, *Tracy* 914; Willow Creek, Trinity River, *Tracy* 3312; Mt. Shasta, acc. *Merriam*.

Refs.—STELLARIA CRISPA C. & S. Linnaea, 1: 51 (1826), type loc. Unalaska. *Alsine crispa* Holz. Contrib. U. S. Nat. Herb. 3: 216 (1895); Merriam, N. Am. Fauna, 16: 145 (1899).

7. **S. littoralis** Torr. Stems stoutish, ascending, very leafy, 1 to 2 feet long; herbage weakly pubescent; leaves rather crowded, ovate, acute, rounded at the sessile base, ¾ to 1¾ inches long; flowers in a terminal compound leafy cyme; pedicels 3 to 5 (or those in the lower forks 7 to 10) lines long; sepals lanceolate, acute, 2 lines long, slightly shorter than the deeply cleft petals; capsule included within the calyx.

Bogs or marshes, seacoast only, from San Francisco north to Humboldt Co. May-June.

Locs.—Cliff House, *Drew*; Pt. Lobos, *Michener & Bioletti*; Pt. Reyes, *Davy* 6731; Bodega Pt., *Eastwood*; Trinidad, *Tracy* 2968.

Refs.—STELLARIA LITTORALIS Torr. Pac. R. Rep. 4: 69 (1857), type loc. Pt. Reyes, *Bigelow*; Jepson, Fl. W. Mid. Cal. 167 (1901). *Alsine littoralis* Greene, Man. Bay Reg. 34 (1894).

8. **S. jamesiana** Torr. (Fig. 97c.) Stems diffuse, 5 to 12 inches high, from slender rootstocks, often with fusiform-thickened joints; herbage minutely glandular puberulent; leaves narrowly lanceolate to ovate or broadly lanceolate, 1¼ to 2 (or 3) inches long, the pairs horizontally spreading; flowers in

loose terminal or axillary cymes on spreading peduncles; peduncles 1 to 2 inches long; pedicels 4 to 10 lines long; sepals 1½ to 2 lines long, the petals twice as long, broadly notched at apex; capsule ovate, shorter than the calyx.

Meadows or pine forest, 5000 to 8500 feet: Sierra Nevada south to Frazier Mt.; North Coast Ranges. East to the Rocky Mts. and north to Washington.

Locs.—Frazier Mt., Ventura Co., *Hall* 6606; Sand Mdw., South Fork Kaweah River, *Jepson* 4687; Hossack Creek, e. Tulare Co., *Hall* 8347; Round Mdw., Giant Forest, *Jepson* 681; Pine Ridge, Fresno Co., *Hall & Chandler* 62; Alder Creek, Yosemite Park, *Jepson* (count of stamens in four flowers, 5, 6, 6, 10); Morgan, Tehama Co., *Hall & Babcock* 4335; Plumas Co., *Platt;* Susanville, *T. Brandegee;* Modoc Co., *M. S. Baker;* Moffitt Creek, Siskiyou Co., *Butler* 966.

Refs.—STELLARIA JAMESIANA Torr. Ann. Lyc. N. Y. 2: 169 (1828), type loc. Rocky Mts. *S. jamesii* Torr. Pac. R. Rep. 4: 69 (1857). *Alsine jamesiana* Heller, Cat. ed. 2, 4 (1900). *A. glutinosa* Heller, Bull. S. Cal. Acad. 2: 67 (1903), type loc. Summit Lake, Mt. Sanhedrin, *Heller* 5880.

3. **SAGINA** L. PEARLWORT.

Diminutive herbs with subulate or filiform leaves. Leaves of the opposite pairs scarious-connate at base. Flowers minute, terminal, often long-pediceled. Sepals 5 or 4, obtuse. Petals white, much shorter than the sepals, rarely subequal, mostly minute, entire or slightly emarginate, or sometimes none. Stamens 5 or 10. Styles as many as the sepals and alternate with them. Capsule dehiscent to the base by entire valves.—Species about 20, all continents. (Latin sagina, fattening, some species abundant in sheep-grazed country.)

Filiform annuals; pedicels straight; low altitudes.
  Sepals and petals 5; connate bases of leaves glabrous................1. *S. occidentalis.*
  Sepals 4; petals commonly none; connate bases of leaves ciliolate........2. *S. apetala.*
More or less succulent, wholly glabrous; biennial or perennial.
  Petals mostly ½ length of sepals; pedicels curved at summit; high altitudes......... 3. *S. linnaei.*
  Petals and sepals subequal; pedicels rarely curved at summit; seashore............... 4. *S. crassicaulis.*

1. **S. occidentalis** Wats. WESTERN PEARLWORT. Inconspicuous annual with almost capillary stems, branching at the base, erect or spreading, 2 to 5 inches high; slightly hispidulous-glandular on the calyx and upper portion of pedicel, otherwise glabrous; upper leaves broadly subulate, acute, 2 to 3 lines long, the lower filiform-linear, 3 to 6 lines long; pedicels 3 to 6 lines long; sepals and petals 5; sepals ¾ line long, the petals nearly as long; calyx rounded at the base; stamens 3 to 10; capsule 1¼ lines in length.

Not uncommon, but obscure and mostly in low ground or borders of salt marshes: Coast Ranges and Great Valley, south to coastal Southern California, north to Siskiyou Co. Far north to British Columbia. Apr.-May.

Locs.—Eureka, *Tracy* 2181; Comptche, *Harriet Walker* 304; Ukiah, *Bolander* 3891 (part of type); Vacaville, *Jepson* 1205a; Montezuma Hills, *Jepson;* Oakville, Napa Valley, *Jepson;* Stege, *Tracy* 610; Berkeley, *Jepson;* Santa Inez Mts., *Brewer* 339 (part of type); Pasadena *McClatchie.*

Refs.—SAGINA OCCIDENTALIS Wats. Proc. Am. Acad. 10: 344 (1875), type spms. from "Oregon to San Francisco"; Jepson, Fl. W. Mid. Cal. 169 (1901); Parish, Zoe, 4: 162 (1893). *Alsinella occidentalis* Greene, Fl. Fr. 125 (1891). The distinctness of this species and S. crassicaulis has been questioned (Piper, Contrib. U. S. Nat. Herb. 11: 259), but altho Sagina is a genus of poorly defined species these two are widely unlike and in respect to each other stand most securely.

2. **S. apetala** Ard. var. **barbata** Fenzl. Tiny annual, erect, 1 to 2 inches high, usually minutely glandular-pubescent; leaves linear-subulate, acute, 1½ to 3 lines long, the connate scarious bases more or less ciliolate; pedicels capillary, erect; calyx 4-parted; petals commonly none, or 4, minute and obovate; capsule ovoid, 1½ times as long as the calyx.

About ranches or near dwellings, therefore probably introduced. Seldom collected but perhaps overlooked.

Locs.—Tehama Co., *Jepson* in 1899; Jackson, *Hansen* in 1892.

Refs.—SAGINA APETALA Ard. Animad. Bot. Sp. Alt. 22, t. 8 (1763). Var. BARBATA Fenzl; Ledeb. Fl. Ross. 1: 338 (1842), type loc. Russia. *S. apetala* Jepson, Fl. W Mid. Cal. 169 (1901). *Alsinella ciliata* Greene, Fl. Fr. 126 (1891), type loc. Ione. *Sagina ciliata* Heller, Muhl. 1: 50 (1904).

3. **S. linnaei** Presl. ARCTIC PEARLWORT. Biennial or perennial; stems numerous, forming a close mat, 1 to 3 inches high, often with leaf-rosettes at base; herbage glabrous; leaves thickish, linear, 3 to 5 or 8 lines long; pedicels filiform, commonly recurved at summit; stamens 10; petals $\frac{1}{2}$ to $\frac{3}{4}$ the length of the sepals; capsule ovate-conic, $1\frac{1}{3}$ to 2 times length of the calyx.

High wet meadows or on rocks, 4000 to 11,000 feet: Sierra Nevada; San Bernardino and San Jacinto mountains; North Coast Ranges. North to Alaska, thence around the earth. June-July.

Locs.—Mt. San Jacinto, *Hall* 2203; Bluff Lake, San Bernardino Mts., *Parish* 3605; Kings Cañon, *Jepson* 769; Bullfrog Lake, *Jepson* 843; Pine Ridge, Fresno Co., *Hall & Chandler* 135; Yosemite, *Hall* 8879; Woolly Creek, w. Siskiyou, *Butler* 48; South Yollo Bolly, *Jepson.*

Refs.—SAGINA LINNAEI Presl. Rel. Haenk. 2: 14 (1835). *Spergula saginoides* L. Sp. Pl. 441 (1753), type Europo-Asiatic. *Sagina saginoides* Britt. Mem. Torr. Club, 5: 151 (1894).

4. **S. crassicaulis** Wats. Glabrous perennial, the stems stoutish and succulent, branching, 1 to 5 inches long, decumbent; leaves linear, thickish, 2 to 9 lines long, the basal forming a rosette, the cauline connate by broad scarious membranes; flowers erect or nodding; petals and sepals subequal, $1\frac{1}{2}$ lines long; stamens 10; capsule ovate, little exserted from the fruiting calyx.

Beaches along the coast from Monterey to Tomales Bay. Washington and British Columbia. June-July.

Locs.—Monterey, *Michener & Bioletti;* cliffs at mouth of Bear Valley, Marin Co., *Davy* 4319; Pt. Reyes, *Davy* 6720, 6756.

Refs.—SAGINA CRASSICAULIS Wats. Proc. Am. Acad. 18: 191 (1883), type loc. Dillon's Beach, Marin Co., *Congdon;* Jepson, Fl. W. Mid. Cal. 169 (1901). *Alsinella crassicaulis* Greene, Fl. Fr. 125 (1891).

4. **ARENARIA** L. SANDWORT.

Low branching annuals, or tufted or matted perennials. Leaves mostly subulate or acerose and pungent, but often linear, lanceolate or ovate. Flowers white, in terminal cymes or heads, rarely solitary and axillary. Sepals 5. Petals 5, entire or nearly so. Stamens 10 Styles 3. Capsule globose or short-oblong, dehiscent into as many entire or 2-cleft valves as there are styles.—Species about 160; around the whole earth save the southern hemisphere of the Old World, but chiefly in cold northern regions. (Latin arena, sand, in which many species grow.)

- Capsule valves 2-toothed or 2-cleft.
  - Leaves linear, lanceolate or ovate (1 or 2 lines broad), not acerose or pungent.
    - Perennial.
      - Plants with running rootstocks; leaves linear-lanceolate....1. *A. macrophylla.*
      - Plants without rootstocks; leaves oblanceolate to linear..........2. *A. saxosa.*
    - Annual; leaves ovate....................................3. *A. serpyllifolia.*
  - Leaves subulate or like pine needles, mostly pungent; perennial.
    - Condensed alpine plant..4. *A. compacta.*
    - Taller or more loosely branched plants.
      - Flowering stems simple, the flowers capitate or umbellate......5. *A. congesta.*
      - Flowering stems branching.
        - Stout or compact; Great Basin species.
          - Rare; foliage glaucous..............................6. *A. aculeata.*
          - More common; not glaucous.......................7. *A. macradenia.*
        - Slender; high Sierra Nevada..........................8. *A. capillaris.*
- Capsule valves entire.
  - Lower altitudes, mostly of the foothills.
    - Swamp plant; perennial......................................9. *A. paludicola.*
    - Dry ground plants; low annuals.

Petals longer than the sepals; common species.
Leaves filiform....................................10. *A. douglasii.*
Leaves lanceolate, broad at base.......................11. *A. californica.*
Petals shorter than sepals or none; northern border, rare.........12. *A. pusilla.*
High altitudes or alpine; leaves subulate or filiform, rather rigid, mostly pungent; sepals acute or pungent.
Cyme strict, 1 to 4-flowered.................................13. *A. propinqua.*
Cyme more or less spreading, several to many-flowered............14. *A. nuttallii.*

SECTION 1. **Moehringia.** Seeds with a strophiole; capsule valves 2-cleft.

1. **A. macrophylla** Hook. Perennial, with running rootstocks; stems ascending or erect, puberulent, 2 to 4 inches high; leaves in 3 to 5 pairs, lanceolate or linear-lanceolate, acute at each end, $\frac{3}{4}$ to $1\frac{1}{2}$ inches long; peduncles slender, terminal or becoming axillary, 1 to 5-flowered; sepals ovate, acute or acuminate, 1 to 2 lines long, exceeding the petals; capsule ovoid, nearly equaling or a little exceeding the calyx.

Shady slopes in the mountains, often on mossy rocks, 1600 to 4000 feet: Southern California north through the Coast Ranges and Sierra Nevada to Siskiyou Co. North to British Columbia. May.

Locs.—Coast Ranges: Stonewall Mine, Cuiamaca Mts., *Parish* 4532; Mt. Hamilton, *Jepson* 4203; Mt. Day, Santa Clara Co., *R. J. Smith;* Grizzly Peak, *Blasdale;* Bell Springs, n. Mendocino, *Davy* 5352; Kneeland Prairie, *Tracy* 2631; Hupa, *Mary Manning;* Shackleford Creek, w. Siskiyou, *Butler.* Sierra Nevada: Plumas Co. (acc. Bot. Cal. 1: 70); Sequoia Mills (now Millwood), *T. Brandegee;* Colony Mill, Sequoia Park, *Jepson* 663.

Refs.—ARENARIA MACROPHYLLA Hook. Fl. Bor. Am. 1: 102, t. 37 (1830), type loc. Strait of Juan de Fuca, *Scouler;* Jepson, Fl. W. Mid. Cal. 168 (1901).

SECTION 2. **Euarenaria.**—Seeds without a strophiole; capsule valves 2-toothed or -cleft.

2. **A. saxosa** Gray. Stems slender, spreading or decumbent at base, arising from a branching root-crown, 5 to 12 inches high; herbage green, glabrous or retrorsely puberulent; leaves oblanceolate to linear, mucronate, 5 to 10 lines long; flowers in a paniculate cyme, more or less leafy bracteate; sepals narrowly ovate, sharply acute, $1\frac{1}{2}$ lines long, the petals almost or quite equaling them.

Southern California east to the Rocky Mts.

Loc.—Santa Ana Cañon, San Bernardino Mts., 8200 ft., *Hall* 7672; only known station in Cal.

Refs.—ARENARIA SAXOSA Gray, Pl. Wright. 2: 18 (1853), type loc. New Mexico, *Wright* 865; Hall, Zoe, 5: 264 (1908).

3. **A. serpyllifolia** L. Stems several from the base, retrorsely puberulent, 3 to 9 inches high; leaves ovate, acute, 1 to 2 lines long; flowers loosely cymose-paniculate, on pedicels 2 to 4 lines long; calyx-lobes ovate-lanceolate, hispidulose on back, $1\frac{1}{2}$ lines long, twice as long as the petals; capsule ovate, equaling the calyx.

Naturalized from Europe. Stream beds, Humboldt Co. and north to Washington.

Locs.—Willow Creek, Trinity River, *Tracy* in 1911; Humboldt Co., on Klamath River, *Chandler* in 1901.

Ref.—ARENARIA SERPYLLIFOLIA L. Sp. Pl. 423 (1753), type European.

4. **A. compacta** Cov. Flowering stems short ($\frac{1}{2}$ to 2 inches high), scantily leafy, glandular-puberulent, rising little above the much-branched crown of a perennial taproot; crown cushion-like, densely leafy, 1 to 2 inches broad; leaves linear, thickish, minutely glandular and minutely denticulate, 1 to 2 lines long; flowers solitary in the axils or terminal, on pubescent pedicels 2 to 3 lines long; sepals $1\frac{1}{2}$ to 2 lines long, shorter than the petals.

High montane, Sierra Nevada from Yosemite Park south, 9000 to 11,600 feet.

Locs.—Mt. Dana, *Jepson* 3313; Big Cottonwood Mdws., near Mt. Whitney (acc. Coville).

Refs.—ARENARIA COMPACTA Cov. Proc. Biol. Soc. Wash. 7: 67 (1892), type loc. near Whitney Mdws., *Coville* 1653; Contrib. U. S. Nat. Herb. 4: 70, pl. 5 (1893).

5. **A. congesta** Nutt. Flowering stems slender, simple, many from the branching or matted crown of a perennial taproot, densely leafy at base, viscid, 4 to 10 inches high; basal leaves setaceous or needle-like, ciliolate-serrate near the base, ½ to ¾ or 2 inches long; cauline leaves reduced to distant bracts 2 or 3 lines long; flowers congested in a head or close cluster, sessile or on pedicels 1 to 2 lines long; sepals broadly ovate, acute; petals oblong, 2 lines long, considerably exceeding the sepals.

High Sierra Nevada and North Coast Ranges, 6000 to 10,000 feet. North to Washington, east to Colorado.

Locs.—Coast Ranges: Snow Mt., *Purpus* 1143; South Yollo Bolly, *Jepson;* Trinity Summit, *Mary H. Manning;* Log Lake near Marble Mt., w. Siskiyou, *Butler* 51. Sierra Nevada: Mt. Bidwell, *Mary H. Manning;* Dixie Mts., Lassen Co., *Baker & Nutting;* Lassen Peak, *R. M. Austin;* Gold Lake, *Hall & Babcock* 4509; Little Cottonwood Creek near Mt. Whitney, *Jepson* 924; Mt. Guyot, *Hall & Babcock* 5527; Farewell Gap, *Hall & Babcock* 5348; Little Kern River, *Purpus* 1780.

Var. **suffrutescens** Rob. Root-crown woody; cauline leaves less reduced; heads umbellate with pedicels 2 to 4 lines long.—Sierra Nevada and far North Coast Ranges. Passing into the type and scarcely worth definition.

Locs.—Sand Meadow, Sequoia Park, *Jepson* 4677; Lost Creek, Sawtooth Range, *Jepson* 4997; Sierra Co., *Lemmon;* Red Clover Creek, Plumas Co., *Hall & Babcock* 4447; Milford, Lassen Co., *T. Brandegee;* Log Lake, w. Siskiyou, *Butler* 51; Union Creek, Salmon Mts., *Hall* 8605.

Refs.—ARENARIA CONGESTA Nutt.; T. & G. Fl. 1: 178 (1838), type loc. n. Rocky Mts., *Nuttall.* Var. SUFFRUTESCENS Rob. Proc. Am. Acad. 29: 295 (1894). *Brewerina suffrutescens* Gray, Proc. Am. Acad. 8: 620 (1873), type spms. from Cisco and Donner, *Bolander, Kellogg. Arenaria suffrutescens* Heller, Muhl. 6: 96 (1910).

6. **A. aculeata** Wats. Flowering branches erect, 4 to 6 inches high, nearly naked; branches of the root-crown many, short, densely leafy at summit, forming a dense mat, only a few of them giving rise to flowering branches; herbage minutely glandular; foliage very glaucous; leaves subulate, pungent, 4 to 8 lines long; flowers in a rather close mostly few-flowered cyme; sepals ovate, 2 lines long, acute, the petals 1½ times as long.

Mountains of the Great Basin; in California reported only from Inyo Co.

Locs.—Argus Mts., *Purpus* 5375; Tonopah, Nev., *Shockley;* Mt. Rose, Washoe Co., Nev., *P. B. Kennedy.*

Refs.—ARENARIA ACULEATA Wats. Bot. King, 40 (1871), type loc. Fremont's Pass, East Humboldt Mts., Nev., *Watson. A. congesta* var. *aculeata* Jones, Proc. Cal. Acad. ser. 2, 5: 626 (1895).

7. **A. macradenia** Wats. Flowering stems erect, often swollen at the joints, 8 to 15 inches high, arising from a woody branching crown 1 to 4 inches high and ending above in a loosely branched cymose inflorescence; herbage glabrous, rarely a little viscid; leaves acerose or subulate, obscurely ciliate at base, ¾ to 2½ inches long, the cauline little or not at all reduced and the basal rarely dense or congested; pedicels 4 to 14 lines long; sepals ovate, very acute, 2½ to 3 lines long, the petals equaling or commonly 1 or 1½ lines longer than the sepals; filaments of stamens opposite sepals with glands at base.

Mountains bordering the Mohave Desert, north to Inyo Co., south to Santa Rosa Mt., and east to Utah and Arizona, 4000 to 7000 feet.

Locs.—Bishop, *Heller* 8357; Lone Pine, *Jones;* Argus Mts., *Purpus* 5088; Pahute Peak, *Purpus* 5086; Greenhorn Mts., *Hall & Babcock* 5080; Rock Creek, w. Mohave Desert, *Davidson;* Mt. Gleason, *Barber* 248; Swartout Cañon, Mt. San Antonio, *Hall* 1276; n. slope San Bernardino Mts., *Parish* 3734; Coyote Cañon, Santa Rosa Mt., *Hall* 2126.

Refs.—ARENARIA MACRADENIA Wats. Proc. Am. Acad. 17: 367 (1882), type loc. Mohave Desert, *Palmer, S. B. & W. F. Parish. A. congesta* var. *macradenia* Jones, Proc. Cal. Acad. ser. 2, 5: 626 (1895). *A. macradenia* var. *parishorum* Rob. Proc. Am. Acad. 29: 296 (1894), type loc. Mohave Desert, *S. B. & W. F. Parish*. *A. congesta* var. *parishorum* Rob. in Gray, Syn. Fl. 1^1: 242 (1897).

8. **A. capillaris** Poir. Flowering stems very slender, bright green and viscid, branching, 2 to 8 inches high, numerous from a matted base of short branches crowning a perennial taproot; leaves chiefly basal, subulate, 4 to 6 lines long, or as much as 1¼ inches long, the cauline few, distant, reduced; inflorescence loosely cymose, the flowers on pedicels 2 to 5 lines long; petals elliptic-obovate or oblong, obtuse, exceeding the elliptic acute sepals.

Granite domes and ridges, Sierra Nevada, 6000 to 10,000 feet, south to the San Bernardino Mts. East to Utah, north to British Columbia; Asia.

Locs.—Sierra Co., *Lemmon;* Webber Lake, *Doten & Kennedy;* Summit, Nevada Co., *Jepson;* Fallen Leaf Lake, *M. S. Baker;* Conness Creek, Tuolumne River, *Jepson* 3358; Mt. Lyell, *Jepson* 3330; Clouds Rest, *Chesnut & Drew;* Little Yosemite, *Jepson* 4401; El Capitan summit, *Jepson* 4366; Black Mt., Fresno Co., *Hall & Chandler* 591.

Var. **ursina** Rob. More condensed and regularly branched; leaves 2 to 3 lines long; sepals blunter, nearly as long as the petals.—Bear Valley, San Bernardino Mts.

Refs.—ARENARIA CAPILLARIS Poir, in Lam. Encycl. 6: 380 (1804), type Siberian. Var. URSINA Rob. in Gray, Syn. Fl. 1^1: 240 (1897). *A. ursina* Rob. Proc. Am. Acad. 29: 294 (1894), type loc. Bear Valley, San Bernardino Mts., *S. B. & W. F. Parish.*

SECTION 3. **Alsine.**—Seeds without a strophiole; capsule valves entire.

9. **A. paludicola** Rob. Glabrous flaccid perennial, the stems procumbent, rooting at the lower joints, sulcate, shining, leafy throughout, 1 to 2½ feet long or when growing amongst tules or other plants to 5 feet long; branches few, very long; leaves linear or linear-lanceolate, thickish, acute, ¾ to 2¼ inches long, slightly connate at base; peduncles solitary in the axils, 1 to 2 inches long, spreading or somewhat deflexed; sepals elliptic, nerveless, herbaceous, 1½ to 2 lines long, about half the length of the obovate petals; capsule oblong, shorter than the calyx.

Swamps, Southern California to Washington. Rarely collected. The angled stems are very noteworthy.

Locs.—Santa Ana River near San Bernardino, *Parish;* near Los Angeles (Davidson, Pl. L. A. Co. 4); formerly at Fort Point, San Francisco.

Refs.—ARENARIA PALUDICOLA Rob. Proc. Am. Acad. 29: 298 (1894). *A. palustris* Wats. Bot. Cal. 1: 70 (1876), not Naud. *Alsine palustris* Kellogg, Proc. Cal. Acad. 3: 61 (1863), type loc. San Francisco, *Bolander. Alsinopsis palustris* Heller, Muhl. 8: 96 (1912).

10. **A. douglasii** Fenzl. Annual, nearly glabrous, sometimes minutely glandular-pilose; stems much branched, 2 to 8 inches high, developing a loosely cymose inflorescence; leaves filiform, 3 to 5 lines long or the lowermost longer; pedicels filiform, 3 or mostly 7 to 13 lines long; flowers numerous; sepals oblong-ovate, narrowly thin-margined, 1 to 1½ lines long; petals obovate or roundish, conspicuous, ½ again as long as the sepals; filaments of those stamens alternate with the petals bearing a yellow bidentate gland on the under side at base; capsule sub-globose; valves rounded at the apex; seeds large, smooth, compressed-reniform, acutely margined.

Sterile soil of hillsides or mesas, 100 to 4000 feet: Coast Ranges and Sierra Nevada; Southern California. Apr.-May.

Locs.—Sierra Nevada: North Tule River, *Purpus* 5683; Kaweah River, *Hopping;* Kinsley, Mariposa Co., *Charlotte M. Hoak;* Jackson, *Hansen;* College City, Colusa Co., *Alice King;* Stillwater, Shasta Co., *M. S. Baker;* Yreka, *Butler* 660. Coast Ranges: Tehama Co., *Jepson;* Hyampum, *Blasdale;* Harris, Humboldt Co., *Ethel Tracy;* Round Valley, *Westerman;* Blue Rock Ridge, Mendocino Co., *Jepson* 1877; Healdsburg, *Alice King;* Mt. George, Napa Range, *Jepson;* Pine Peak, Vaca Mts., *Jepson;* Burlingame, *C. E. Durrell;* Livermore Valley, *Jepson;* San Miguelito Rancho, Santa Lucia Mts., *Jepson* 1644; San Bernardino Valley, often whitening wide areas on the sandy mesas, *Parish*; Chalk Hill, Mt. San Jacinto, *Jepson*; Coahuilla Valley to Aguanga, *Jepson* 1477; Julian, San Diego Co., *T. Brandegee*.

Refs.—ARENARIA DOUGLASII Fenzl; T. & G. Fl. 1: 674 (1840), type from California, *Douglas*; Jepson, Fl. W. Mid. Cal. 168 (1901). *Alsinopsis douglasii* Heller, Muhl. 8: 20 (1912).

A. HOWELLII Wats. Proc. Am. Acad. 20: 354 (1885), type loc. Waldo, Ore., *Howell*. Annual; stems erect, very slender, branching freely from the base, ¾ to 1½ feet high; herbage purplish, the leaves, nodes and sepals sparingly glandular-pubescent, otherwise mainly glabrous; leaves crowded at base of stem, scattered and reduced above, lanceolate, thickish, acutish, sessile by a broad base, becoming rigid in age, 3 to 5 lines long; petals ovate, attenuate, much exceeding the abruptly acute sepals; capsule valves narrowed to an acutish apex; seeds 2, somewhat flattened, minutely papillate or tuberculate-crested on the margin. —Josephine Co., Oregon, on Shelley Creek-Waldo road near California boundary, *Jepson* 2922. The plant in its early flowering stage is very similar to A. douglasii; as it ages the stems become more rigid and more purple, and its aspect is greatly changed.

11. **A. californica** Brewer. Stems delicate and filiform, diffusely branching from the base, 1 to 4 inches high, the flowers loosely cymose on pedicels 3 to 8 lines long; herbage glabrous; leaves lanceolate, obtuse, very short, slightly fleshy, 1 to 2 lines long; sepals oblong-ovate, 1½ lines long, the petals oblong, 1½ times as long; seeds small, finely roughened.

Gravelly hillslopes or disintegrating rock outcroppings in the Coast Ranges from Mt. Hamilton to Mendocino Co. and northward; and in the Sierra Nevada from El Dorado Co. north to Butte Co.; 100 to 2000 feet. Southern Oregon. Apr.-May.

Locs.—Coast Ranges: Lake Merced, San Francisco, *Tracy* 1815; Berkeley Hills, *Tracy* 1798; St. Helena, *Clara Hunt*; Kelseyville, *Irwin*; Scotts Valley, Lake Co., *Tracy* 1658; Long Valley, Mendocino Co., *Bolander* 4684; Crane Creek, Tehama Co., *Jepson*. Sierra Nevada: Rose Sprs., El Dorado Co., *M. H. Gates*; Auburn, *Bolander* 4543; Marysville Buttes, *Jepson*; Rough & Ready, Nevada Co., *Jepson*; plains east of Chico, *R. M. Austin*.

Refs.—ARENARIA CALIFORNICA Brewer, Bot. Cal. 1: 69 (1876); Bolander, Cat. Pl. S. F. 6 (1870) as a nomen nudum; Jepson, Fl. W. Mid. Cal. 168 (1901). *A. brevifolia* var. ? *californica* Gray, Proc. Cal. Acad. 3: 101 (1864), based on Californian spms. by *Fremont* (no. 284) and *Brewer* (from Sonoma). *Alsinopsis californica* Heller, Muhl. 8: 10 (1912).

12. **A. pusilla** Wats. Stems simple or several from the base, capillary, 1 to 2 inches high; leaves lanceolate, 1 to 2 lines long; sepals ovate-lanceolate, acute, 1 line long; petals lanceolate or narrowly ovate, nearly transparent, shorter than the sepals, or more minute, or none; stamens 3, rarely 4 or 5; capsule scarcely equaling the calyx; seeds smooth.

Dry pine woods, northern border of California and north to Washington. Appears like a reduced form of A. californica.

Locs.—Quartz Valley, Siskiyou Co., *Butler* 619 (petals sprinkled on the upper side with small roughish dots); *Tracy* 3130, on sand-dunes at Humboldt Bay, appears to be the same.

Refs.—ARENARIA PUSILLA Wats. Proc. Am. Acad. 17: 367 (1882), type loc. Yreka, *Greene*. *Alsinopsis pusilla* Heller, Muhl. 8: 96 (1912).

13. **A. propinqua** Rich. Tufted, 1 to 3 inches high, with numerous filiform stems mostly leafy at base and ending above in a rather strict 1 to 4-flowered cluster; herbage glandular-puberulent; leaves linear-subulate, 1½ to 2½ lines long; flowers small; sepals ovate to ovate-lanceolate, acute, 1 to 1½ lines long, strongly 3-nerved on the back, larger than the petals.

Siskiyou Co., 8000 feet. Arizona to Oregon and far northward.

Locs.—Marble Mt., *Chandler* 1673. The plant of the San Bernardino Mts. referred to *A. verna* var. *hirta* in Syn. Fl. 1^1: 246 belongs to the next species.

Refs.—ARENARIA PROPINQUA Rich.; Franklin, Jour. 738 (1823), type from boreal N. Am. *Alsinopsis propinqua* Rydb. Bull. Torr. Club, 33: 140 (1906). *Arenaria verna* L. var. *hirta*, Wats. Bot. King, 41 (1871).

14. **A. nuttallii** Pax. Stems prostrate or ascending, many from the crown of a perennial taproot, more or less matted, giving rise to erect flowering branches which are commonly densely leafy at base; herbage glandular-puberulent; leaves subulate, rigid, pungent, 3 to 5 lines long; flowers rather loosely and divergently cymose, on pedicels 3 to 6 lines long; sepals lanceolate, or oblong-lanceolate, very acute, 2 to 2½ lines long, equaling or exceeding the petals.

Northern borders of California: Lassen Peak and Mt. Eddy. North to Oregon and Montana.

Var. **gracilis** Rob. Plant more compact and regular; sepals lanceolate-subulate, acuminate or shortly awn-tipped, 2½ to 3 lines long, the midnerve on the back very strong; petals oval or oblong-ovate, acute or acuminate, much shorter than the sepals. Decomposed granite, 9000 to 12,000 feet: Sierra Nevada from Yosemite Park south to Farewell Gap; San Bernardino and San Gabriel mountains. Passing into the typical form.

Locs.—Sierra Nevada: Rock Creek, Mt. Whitney, *Jepson* 5060; Siberian Pass, Tulare Co., *Hall & Babcock* 5479; Little Kern River, *Purpus* 5253; Mineral King, *T. Brandegee;* Kaweah Peak, *Jepson* 4999; Alta Mdws., *G. B. Grant* 5318; Mt. Silliman, *Jepson* 753; Mt. Goddard, *Hall & Chandler* 620; mountains above Mariposa Big Trees, *Bolander* 4976; Sonora Pass, *Brewer* 1879. Southern California: Mt. San Gorgonio (Grayback), *W. G. Wright;* Mt. San Antonio, *McClatchie* 182.

Var. **gregaria** Jepson n. comb. Flowering stems numerous, 3 to 5 inches high, ending above in a cymose panicle, leafy-imbricated at base and borne on ascending or creeping stems arising from the crown of a taproot; herbage purplish or green, clammy or softly viscid-pubescent; leaves subulate, 3 to 5 lines long, blunt; flowers more or less clustered in a many-flowered panicle, 1 to 2½ inches high, the pedicels ½ to 2 (or 3) lines long; sepals often purplish, oblong-ovate or -lanceolate, shortly acute or acuminate, 2 to 2½ lines long, commonly exceeded by the oblong-lanceolate or narrowly obovate petals.

Rocky ridges, high North Coast Ranges, 4000 to 7000 feet. July. This is so unlike var. gracilis that the two have the quality of distinct species. But southern forms of var. gracilis pass into the species, and, as there are forms intermediate between var. gregaria and the species, these two varieties are thus connected in a continuous series.

Locs.—Snow Mt., *T. Brandegee;* Mt. Hull, *Hall* 9530; South Yollo Bolly, *Jepson;* Lasseck Peak, *Goddard* 658; Devils Backbone, s. w. Siskiyou, *Jepson* 2065; near Preston Peak, w. Siskiyou, *Jepson* 2871; Goosenest foothills, *Butler* 1638. *Hall* 8578, Salmon Mts., connects this variety with the species.

Refs.—ARENARIA NUTTALLII Pax in Engler, Bot. Jahrb. 18: 30 (1894). *A. pungens* Nutt. (not Clem.); T. & G. Fl. 1: 179 (1838), type loc. n. Rocky Mts., *Nuttall.* Var. GRACILIS Rob. Proc. Am. Acad. 29: 304 (1894), type spms. from mt. above Mariposa Grove, *Bolander,* and from Tulare Co., *Palmer, Coville & Funston.* Var. GREGARIA Jepson. *A. gregaria* Heller, Bull. S. Cal. Acad. 2: 67 (1903), type loc. Mt. Sanhedrin, *Heller* 5892. *Alsinopsis gregaria* Heller, Muhl. 8: 96 (1912).

5. **SPERGULARIA** J. & C. Presl. SAND SPURREY.

Low herbs, usually of alkaline plains, borders of salt marshes, or maritime. Leaves linear or subulate-filiform, semi-terete, with scarious stipules. Flowers cymose or racemose, the pedicels at length spreading or deflexed. Sepals 5. Petals 5, purplish or white, entire. Stamens commonly 10. Style 3, rarely 5. Capsule 3-valved. Seeds often wing-margined. Embryo annular.—Species about 15, widely distributed on seashores and in saline localities all over the earth. (Derivative of Spergula.)

Perennials.
  Erect or ascending, more or less succulent, with fusiform fleshy roots; saline or seacoast habitats..1. *S. macrotheca.*
  Prostrate, not obviously succulent; roots fibrous, not fleshy-fusiform.
    Stems long and somewhat straggling, from a matted or tufted center, flowering from the middle to the ends of the branches........................2. *S. rubra.*
    Plants matted; flowering mostly at the ends of the branches.......3. *S. clevelandii.*
Annuals, quite erect or ascending.
  Herbage more or less pubescent; saline habitats.
    Capsules slightly longer than the sepals; petals 5, nearly equaling the sepals........ 4. *S. salina.*
    Capsules nearly twice as long as the sepals; petals 3 to 5, ½ to ¾ as long as the sepals...5. *S. tenuis.*
  Herbage glabrous; flowers ½ to 1 line long; dried ponds.................6. *S. platensis.*

1. **S. macrotheca** Heynh. Stems stout, 7 to 12 inches high, erect or ascending from the short, often branched, woody crown of a very thick and fleshy taproot; herbage deep green and viscid-pubescent throughout, rarely subglabrous; leaves narrowly linear, 1 to 1½ inches long; flowers in terminal cymes, their branches often racemose; pedicels 2 to 7 lines long; sepals 3 to 4 lines long, scarious-margined; petals as long, pink; capsule equaling or a little exceeding the calyx; seeds with or without a wing, even in the same capsule.

Sandy borders of salt marshes, coast region of California.

Locs.—Humboldt Bay, *Tracy* 3093; Pt. Reyes, *Davy* 6773; Benicia, *Jepson;* Pt. Isabel, *Blasdale;* West Berkeley, *Jepson;* Alameda, *Jepson;* Morro, San Luis Obispo Co., *Barber;* Oceanside, San Diego Co., *Parish* 4451.

Var. **leucantha** Rob. Glabrous, especially below, or more lightly pubescent; infloresence looser; flowers commonly white. Alkaline plains of the interior valleys: Sacramento, San Joaquin and Livermore valleys; south to Southern California. May-June.

Locs.—Willows, *Jepson;* Lathrop, *Greene;* Livermore, *Michener & Bioletti;* Bakersfield, *Davy* 1856; Antelope Valley, *Davy* 2256; San Bernardino, *Parish* 4464; San Jacinto, *Jepson* 1244.

Var. **scariosa** Rob. Herbage pale, glandular-pubescent or almost glabrous; stipules ovate, acuminate, 4 to 5 lines long, conspicuously silvery-scarious; flowers scattered and on pedicels 3 to 7 lines long or less, or in reduced terminal cymes.—Sea-bluffs, San Francisco to Monterey.

Locs.—Pt. Richmond, *Hall;* San Francisco, *Greene;* Montara Pt., San Mateo Co., *Copeland;* Pacific Grove, *Tidestrom.*

Var. **talinum** Jepson n. comb. Slightly woody at base; internodes very short (2 to 5 lines mostly), the stems densely clothed with leaves; herbage heavily glandular-pubescent or nearly glabrous; cyme shortly peduncled.—San Clemente Island, *T. Brandegee.*

Refs.—SPERGULARIA MACROTHECA Heynh.; Rob. in Gray, Syn. Fl. 1^1: 252 (1897). *Arenaria macrotheca* Hornem. in C. & S. Linnaea, 1: 53 (1826), type from California. *Lepigonum medium* of some Californian distributions. Var. LEUCANTHA Rob. Proc. Am. Acad. 29: 313 (1894). *Tissa leucantha* Greene, Pitt. 1: 301 (1889), type loc. western side of the lower San Joaquin and adjacent Livermore Valley. Var. SCARIOSA Rob. l. c. *Tissa macrotheca* var. *scariosa* Britt. Bull. Torr. Club, 16: 129 (1889), type spms. from San Francisco and Monterey. *Tissa pallida* Greene, in Britt. l. c., type loc. San Francisco, *Greene.* *Tissa valida* Greene, Erythea, 1: 107 (1893), type loc. Santa Cruz Isl., *Greene.* Var. TALINUM Jepson. *Tissa talinum* Greene, Erythea, 1: 106 (1893), type loc. Guadalupe Island, Lower California.

2. **S. rubra** J. & C. Presl, var. **perennans** Rob. Stems prostrate, 4 to 9 inches long, slender and wiry, many from a densely tufted base, branching little, flowering from about the middle; herbage comparatively glabrous; leaves narrowly linear, 1½ to 5 lines long; stipules ovate, silvery-scarious, 2 lines long, very conspicuous; pedicels slender, 2 to 3 (or 5) lines long; sepals

oblong, acute, 1½ to 2 lines long; petals red or reddish, about equaling the sepals; capsule not exceeding the calyx; seeds with a marginal elevation.

Beaten paths and by roadsides. Northern California. May. Introduced from Europe, spreading slowly, but gradually becoming more common.

Locs.—Eureka, *Tracy* 2497; Shasta Springs, *Jepson;* Redding, *Baker & Nutting;* Bear Valley, Nevada Co., *Jepson;* Denverton, *Jepson;* upper Napa Valley, *Jepson;* Mt. Eden, *K. Brandegee.*

Refs.—SPERGULARIA RUBRA J. & C. Presl, Fl. Cech. 94 (1819). *Arenaria rubra* L. Sp. Pl. 423 (1753), type European. Var. PERENNANS Rob. in Gray, Syn. Fl. 1^1: 250 (1897). *Tissa rubra* var. *perennans* Greene, Pitt. 2: 229 (1892). *Lepigonum rubrum* var. *perennans* Kindb. Monog. 41 (1863), type from Sweden.

3. **S. clevelandii** Rob. Perennial, the prostrate stems forming deep green mats 5 to 13 inches broad; herbage viscid-glandular; leaves filiform, conspicuously fascicled in the axils, ascending, 6 to 9 lines long, all longer than the internodes; flowers in terminal cymes; sepals oblong, acute, 2 lines long; corolla white, about equaling the calyx; seeds winged or not winged, even in the same pod.

Sandy soil near the ocean: San Diego and San Francisco cos.

Locs.—San Francisco, *Jepson;* Chula Vista, *Geo. B. Grant* 1238; San Diego, *T. Brandegee;* National City, *Abrams* 3525.

Refs.—SPERGULARIA CLEVELANDII Rob. Proc. Am. Acad. 29: 310 (1894). *Tissa clevelandii* Greene, Fl. Fr. 127 (1891), type loc. San Diego, *Cleveland. T. villosa* Britt. Bull. Torr. Club, 16: 129 (1889). *T. rubra* K. Brandegee, Zoe, 4: 84 (1893).

4. **S. salina** J. & C. Presl. Stems branching, erect, or sometimes diffuse and prostrate, 3 to 8 inches long; herbage somewhat fleshy, nearly glabrous or lightly pubescent; leaves narrowly linear, ¾ to 1⅓ inches long, commonly shorter than the internodes; flowers in terminal cymes, the branches often racemose; pedicels leafy-bracted or the upper bractless, not exceeding the capsules; sepals oblong-ovate, obtusish, scarious-margined, 2 lines long, the petals nearly as long; capsule slightly longer than the calyx.

Alkaline plains of the Sacramento and San Joaquin, westward to the salt marshes near the coast, and south to Southern California. North Atlantic Coast. Europe. May-Aug.

Locs.—Calistoga, *Tracy* 1858; Denverton, *Jepson;* Stockton, *Sanford;* Walnut Creek, *Jepson;* San Felipe, Santa Clara Co., *Jepson;* West Berkeley, *Tidestrom;* Alameda, *Jepson;* Los Angeles, *Geo. B. Grant* 4583; West Riverside, *F. M. Reed.*

Var. **sordida** Jepson n. comb. Leaves dark with a heavy glandular indument; branches of the cymes secund, rather dense.—Marshes about San Francisco Bay (Alameda, Searsville).

Refs.—SPERGULARIA SALINA J. & C. Presl, Fl. Cech. 95 (1819), type European; Jepson, Fl. W. Mid. Cal. ed. 2, 156 (1911). *Tissa marina* Britt. Bull. Torr. Club, 16: 126 (1889), not *Tissa salina* Britt. *T. salina* var. *sanfordi* Greene, Fl. Fr. 129 (1891), type loc. lower San Joaquin. Var. SORDIDA Jepson. *Tissa salina* var. *sordida* Greene, l. c., type loc. Bay Farm Island.

5. **S. tenuis** Rob. Annual; stems dichotomously and copiously branched from the base, erect or diffuse, 3 to 5 inches high, the branches slender and internodes long; herbage scarcely fleshy, lightly viscid-puberulent; leaves linear-filiform, 4 to 7 lines long, shorter than the internodes; flowers ¾ to 1 line long, in terminal cymes, numerous, short-pediceled, the uppermost sessile in close clusters; sepals oblong-ovate; stamens 2 to 5; capsule twice as long as the fruiting sepals or nearly.

Saline plains, Sacramento Valley southward to Southern California.

Locs.—Willows, *Jepson;* Newark, *Davy* 1113; San Felipe, Santa Clara Co., *Jepson;* Delano, Kern Co., *Davy* 2438; (?) Barstow, *Jepson* 4797; Santa Monica (acc. Abrams, Fl. Los Ang. 149).

Refs.—SPERGULARIA TENUIS Rob. Proc. Am. Acad. 29: 311 (1894). *Lepigonum tenue* Greene, Pitt. 1: 63 (1887), type loc. Alameda salt marshes, *Greene*, May, 1887. *Tissa tenuis* Greene in Britt. Bull. Torr. Club, 16: 128 (1889). *T. salina* var. *tenuis* Jepson, Fl. W. Mid. Cal. 170 (1901). *Spergularia salina* var. *tenuis* Jepson, l. c. ed. 2, 156 (1911).

As this seems to pass into S. salina we have hitherto held it as a variety of that species. While it has a somewhat distinctive habit it is still too little known and is here reluctantly given specific rank. The var. *involucrata* Rob. in Gray, Syn. Fl. 1^1: 251 (1897), type loc. Mt. Eden, *K. Brandegee*, is a form with the flowers in somewhat capitate clusters subtended by long foliaceous bracts.

6. **S. platensis** Fenzl. Annual; stems numerous, nearly filiform, branching, 1½ to 3½ inches high; herbage glabrous; leaves linear-filiform, 3 to 8 lines long, mostly shorter than the internodes; upper leaves much reduced, not exceeding the scarious stipules; flowers in terminal cymes, the branches somewhat racemose; pedicels 1 to 2 lines long; flowers ½ to 1 line long; petals 1 to 3 and minute, or lacking; capsule somewhat exceeding the sepals.

Dried ponds, Southern California. East to Texas. Brazil.

Locs.—Between Rivera and Florence on the adobe mesa, *Abrams* 3252; Carrizo Creek, *T. Brandegee*.

Refs.—SPERGULARIA PLATENSIS Fenzl, Ann. Wien. Mus. 2: 272 (1839). *Balardia platensis* Cambess. in St. Hil. Fl. Bras. Merid. 2: 180, t. 111 (1829), type loc. s. Brazil. *Lepigonum gracile* Wats. Proc. Am. Acad. 17: 367 (1882), type spms. from Dallas, Tex., *J. Reverchon*, and Wilmington and Compton, Cal., *Nevin*. *Tissa gracilis* Britt. Bull. Torr. Club, 16: 128 (1889).

6. SPERGULA L. SPURREY.

Annual. Leaves narrowly linear or subterete, apparently in whorls, but really opposite, several others of their own size being crowded in the axils; stipules small and scarious. Flowers symmetrical. Sepals 5. Petals 5, white, entire. Stamens 10, occasionally 5. Styles 5, alternate with the sepals. Capsule 5-valved, the valves entire, opposite the sepals. Embryo spirally annular.—Species 2 or 3, in both hemispheres. (Latin spargere, to scatter, in reference to the dispersion of the seeds.)

1. **S. arvensis** L. CORN SPURREY. Diffusely branching from the base, the stems 1 to 2 feet long; pubescence of short spreading glandular hairs; leaves slightly fleshy, ¾ to 1¼ inches long, numerous in rather remote whorls; flowers white, 4 lines broad, in a cymose panicle with strongly divergent branches turned abruptly downward after flowering; petals ovate, exceeding the sepals.

Fields and orchards near the coast, rarely in the interior. Apr. Introduced European weed. Readily eaten by cattle and said to increase the flow of milk. Flowers opening only of afternoon.

Locs.—San Diego, *T. Brandegee* in 1901; Pasadena (Erythea, 1: 102); Monterey, *Jepson* 2996 in 1908; Berkeley, *Jepson* in 1886; Mt. Diablo, *Brewer* in 1862; Olema, *Jepson* 4038 in 1910; Eureka, *Tracy* 2983 in 1909; Ione, *Braunton* in 1904.

Refs.—SPERGULA ARVENSIS L. Sp. Pl. 440 (1753), type European; Jepson, Fl. W. Mid. Cal. 170 (1901).

7. POLYCARPON L.

Low much-branched annuals with numerous flat leaves, small scarious stipules and very small flowers in cymes. Sepals 5, more or less carinate, scarious-margined. Petals 5, hyaline, shorter than the sepals. Stamens 3 to 5. Style 1, very short, 3-cleft or the stigma 3-lobed. Capsule 3-valved. Seeds several. Embryo little curved.—Species about 6, temperate and tropic regions. (Greek polus, many, and karpos, fruit, in reference to the numerous pods.)

Leaves in 4s or opposite; inflorescence leafless..........................1. *P. tetraphyllum.*
Leaves opposite; inflorescence more or less leafy..........................2. *P. depressum.*

1. **P. tetraphyllum** L. Stems diffuse or prostrate, 2 to 5 inches long; herbage glabrous or nearly so; leaves in 4s or opposite, oblong or obovate, short-

petioled, 2 to 6 lines long; cyme leafless, many-flowered, dense, the flowers 1 line long, short pediceled; sepals green or purplish, strongly keeled, apiculate-hooded; style slender, ⅔ as long as the ovary; stigma 3-lobed; capsule nearly equaling the calyx.

Beaten gravelly places. Naturalized from Europe. July-Aug.

Locs. Vallejo, *Michener & Bioletti* in 1892; St. Helena, *Jepson* in 1897; Berkeley, *Tracy* in 1903.

Refs. POLYCARPON TETRAPHYLLUM L. Syst. Nat. ed. 10, 881 (1759); Jepson, Fl. W. Mid. Cal. 171 (1901). *Mollugo tetraphylla* L. Sp. Pl. 89 (1753), type European.

2. **P. depressum** Nutt. Plants prostrate, 1 to 3 inches broad with slender stems; leaves spatulate, varying to obovate, obtuse or acute, ½ to 2 lines long; flowers ½ as large as in the preceding; sepals not keeled or scarcely so, about ½ line long; petals white, membranous, linear, ½ as long as the sepals; style very short, 3-cleft.

Southern California, from the coast east to the base of the San Bernardino Mts.; Monterey Co.

Locs. Pajaro Hills, *Chandler* 426; San Bernardino, *Parish* 3643; Claremont, Los Angeles Co., *C. F. Baker;* Avalon, *F. M. Reed* in 1909; San Diego, *T. Brandegee.*

Refs.—POLYCARPON DEPRESSUM Nutt.; T. & G. Fl. 1: 174 (1838), type loc. San Diego, *Nuttall;* Jepson, Fl. W. Mid. Cal. 171 (1901).

8. LOEFLINGIA L.

Low rigid annuals, dichotomously branched from the base, with subulate leaves and setaceous stipules. Flowers small, sessile in the axils. Sepals acuminate or awn-tipped, the outer with a tooth on each side. Petals 3 to 5, minute or none. Stamens 3 to 5. Style 1, very short or none; stigmas 3. Capsule 3-valved, several-seeded.—Species 5, North America, Mediterranean region, Asia. (Peter Loefling, Swedish traveler of the 18th century.)

Sepals recurved; style very short but present............................1. *L. squarrosa.*
Sepals straight; style none..2. *L. pusilla.*

1. **L. squarrosa** Nutt. Stems diffusely branched from base, 2 to 5 inches high; herbage glandular-pubescent; leaves cuspidate, squarrose-spreading, 2 to 3 lines long; petals very minute; sepals rather strongly recurved and squarrose; capsule shorter than the sepals.

San Diego north to the Sacramento and San Joaquin valleys; Sierra Co. (acc. Syn. Fl. 1^1: 255).

Locs.—San Diego, *T. Brandegee;* Pasadena, *Grant;* San Bernardino, *Parish* 7104; Oakdale, *Jepson.*

Refs.—LOEFLINGIA SQUARROSA Nutt.; T. & G. Fl. N. Am. 1: 174 (1838), type loc. San Diego, *Nuttall;* Jepson, Fl. W. Mid. Cal. 171 (1901).

2. **L. pusilla** Curran. Much like the preceding but more delicate; stems spreading, 2 to 3 inches long; sepals narrowly lanceolate, abruptly acute, entire, neither rigid nor squarrose; petals none; stamens 3; capsule as long as the sepals.

Tehachapi, 4000 feet.

Ref.—LOEFLINGIA PUSILLA Curran, Bull. Cal. Acad. 1: 152 (1885), type loc. Tehachapi, *Mary K. Curran.*

9. HERNIARIA L.

Ours a very small annual, with minute scarious stipules. Flowers minute, green, in clusters, crowded, sessile. Sepals 5 or 4, united at base. Petals setaceous and minute, or none. Stamens 2 to 5, inserted on the calyx base. Style very short, 2-cleft or -parted. Fruit a 1-seeded indehiscent achene, with a thin pericarp, enclosed in the calyx.—Species about 20, Europe, Asia, Africa. (Latin hernia, a rupture, which one species was thought to cure.)

JEPSON, Fl. Cal. vol. 1, pp. 465-496, Dec. 21, 1914.

1. **H. cinerea** DC. Tiny erect plants, 1 to 2½ inches high, or sometimes forming prostrate mats 3 to 14 inches broad, the branches bearing 2-ranked branchlets; herbage hispidulous; leaves oblong-oblanceolate, 1½ to 2½ lines long; flowers in all the axils, even the lowest; calyx ½ line long, very hispid.

San Joaquin region at the edge of the foothills on either side of the valley. Naturalized from southern Europe. May-June.

Locs.—Wawona, *Congdon* in 1897; Oakdale, *Jepson* in 1896; Escalon, *Eastwood* in 1905; Stockton and Tracy, *K. Brandegee* in 1907.

Refs.—HERNIARIA CINEREA DC. Fl. Fr. Suppl. 375 (1815), type European; Jepson, Fl. W. Mid. Cal. 172 (1901). *Paronychia pusilla* Greene, Pitt. 1: 302 (1889), type loc. Bethany, San Joaquin Co., *Greene*.

10. PENTACAENA Bartl.

Tufted perennials with subulate pungent leaves and silvery-hyaline stipules. Flowers sessile, clustered in the axils. Sepals 5, almost distinct, very unequal, hooded, the 3 outer larger, and with a stout divergent terminal spine, the 2 inner smaller and with a shorter spine. Petals minute, scale-like. Stamens 3 to 5, inserted at the base of the sepals. Style very short, bifid. Utricle enclosed in the rigid persistent calyx.—Species 5, Pacific North America and andine South America. (Greek pente, five, and akaina, a thorn, the five sepals spine-tipped.)

1. **P. ramosissima** H. & A. SAND MAT. Stems prostrate, forming dense mats 5 to 18 inches broad, pubescent; leaves crowded on the stems, 2 to 4 lines long, the stipules ½ or sometimes nearly as long; calyx 1½ to 2 lines long; sepals hairy or woolly below the divergent spinose apex; utricle apiculate.

On sand-dunes or in sandy soil along the entire California coast. In Southern California extending inland 25 miles. North to Washington, south to Mexico. Chile. Apr.-May.

Locs.—San Diego, *G. W. Dunn*; Delmar, *Jepson* 1614; Pala and Poway, acc. *Parish*; Oceanside, *Parish* 4439; Santa Rosa Island, *P. M. Jones*; Santa Cruz Island, *T. Brandegee*; Arroyo Grande, *Alice King*; Pacific Grove, *Jepson*; San Francisco, *C. F. Baker* 2998; Humboldt Bay, *Tracy* 3018.

Refs.—PENTACAENA RAMOSISSIMA H. & A. in Hook. Bot. Misc. 3: 338 (1833), type from Chile; Jepson, Fl. W. Mid. Cal. 172 (1901). *P. polycnemoides* Bartl. in Presl, Rel. Haenk. 2: 5, t. 49, fig. 1 (1835).

11. PARONYCHIA L. WHITLOW-WORT.

Prostrate tufted perennial, with scarious stipules and clustered axillary flowers. Sepals 5, almost distinct, equal, linear or oblong, concave or cucullate under the apex, the very tip furnished with a short bristle or cusp. Petals filament-like, or minute teeth, or none. Stamens 5, inserted on the base of the sepals. Ovary 1-ovuled. Style deeply 2-parted. Fruit a utricle enclosed in the persistent calyx, at length bursting longitudinally.—Species 40, all continents except Australia. (Greek paronuchia, a whitlow or felon, the name applied to an herb used as a remedy.)

1. **P. franciscana** Eastw. Stems 4 to 12 inches long, tough, the internodes very short (only 1 to 2 lines long at base); leaves oblanceolate, acute, cuspidate, 2 to 4 lines long, much crowded on the branches and branchlets, especially towards the ends; stipules hyaline; flowers 1 line long, obviously pedicelled, 3 or 4 in the axils.

Grassy hilltops, San Francisco and Bodega Port. Introduced from Chile where it is native. Apr.-June.

Refs.—PARONYCHIA FRANCISCANA Eastw. Bull. Torr. Club, 28: 288 (1901), type spms. from San Francisco and Bodega Port. *P. chilensis* Greene, West Am. Sci. 3: 156 (1887) and Fl. Fr. 131 (1891), not DC; Jepson, Fl. W. Mid. Cal. 172 (1901).

12. ACHYRONYCHIA T. & G.

Glabrous plants with spatulate leaves and large hyaline stipules. Leaves of the opposite pairs unequal. Flowers bright silvery-white by reason of the scarious calyx-lobes, borne in dense axillary cymose clusters. Calyx-lobes 5. Petals none. Stamens 10 to 15, only 1 to 5 anther-bearing. Style bifid, included. Utricle thin, included in the calyx.—Species 2, California and Mexico. (Greek achuron, chaff, and onyx, onychos, a finger nail, in reference to the thin shining calyx-lobes.)

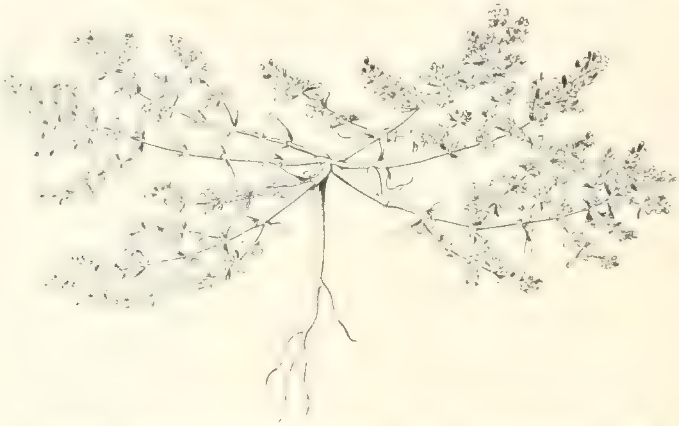

Fig. 98. ACHYRONYCHIA COOPERI T. & G.; entire plant, x $\frac{2}{3}$.

1. **A. cooperi** T. & G. (Figs. 98 and 99a.) Stems 2 to 5 inches long, slender, prostrate, radiating from the crown of an annual root; leaves spatulate, $1\frac{1}{2}$ to 9 lines long; flowers 1 line long, in conspicuous dense axillary cymes; calyx-lobes scarious, their lower third fleshy-herbaceous like the urn-shaped calyx-tube.

Sandy washes and valleys, Mohave and Colorado deserts. Lower California. May.

Locs.—Needles, *Jones* 3790; Salt Well, Mohave Desert, *Hall & Chandler* 6891; Carrizo Creek, *T. Brandegee;* Conchilla Desert, *Jepson* 6053; Indian Well, *Hall* 5773; Split Mt., *Parish* 9051.

Ref. ACHYRONYCHIA COOPERI T. & G. Proc. Am. Acad. 7: 331 (1868), type loc. Camp Cady (near Daggett), *Cooper*.

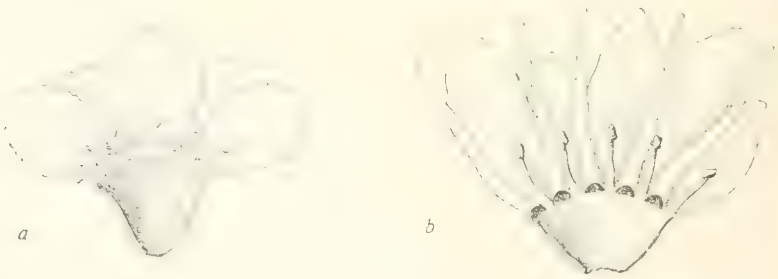

Fig. 99. *a*, ACHYRONYCHIA COOPERI T. & G., flower laid open. *b*, EREMOLITHIA RIXFORDII Jepson; flower laid open. x 7.

13. **EREMOLITHIA** Jepson nov. gen.

Perennial with erect stems and linear leaves. Stems arising from a woody root crown crowded with scales and lacerate-fringed stipules. Flowers sessile in small axillary 1 to 3-flowered clusters. Calyx tube $\frac{1}{4}$ to $\frac{1}{3}$ as long as the lobes, the 5 lobes membranous with a central lanceolate green spot. Stamens 10, 5 fertile, the 5 lanceolate staminodes petaloid, each bearing at base a circular red scale. Style long but not exserted, 3-cleft. Fruit unknown.—(Herbae perennes caulibus erectis et foliis linearis. Folia caulinia e paribus aequalibus. Caudex brevis lignosus, squamis membranaceis et stipulis membranaceis fimbriatis dense confertis. Flores sessiles cymis parvis axillaribus 1 ad 3-floribus. Calycis lobi membranacei macula media virida lanceolata, tubo herbaceo ter vel quater longiores. Stamina 10, altera 5 filamentis antheriferis, altera 5 filamentis infertilibus petaloideis lanceolatis quibusque ad basin squamis rotundis rubris instructis. Stylus longus, apice breviter trifidus, non exsertus. Fructus ignotus.)—Species 1. (Greek eremos, desert, and lithos, rock, the plants growing in rocky places in the desert.)

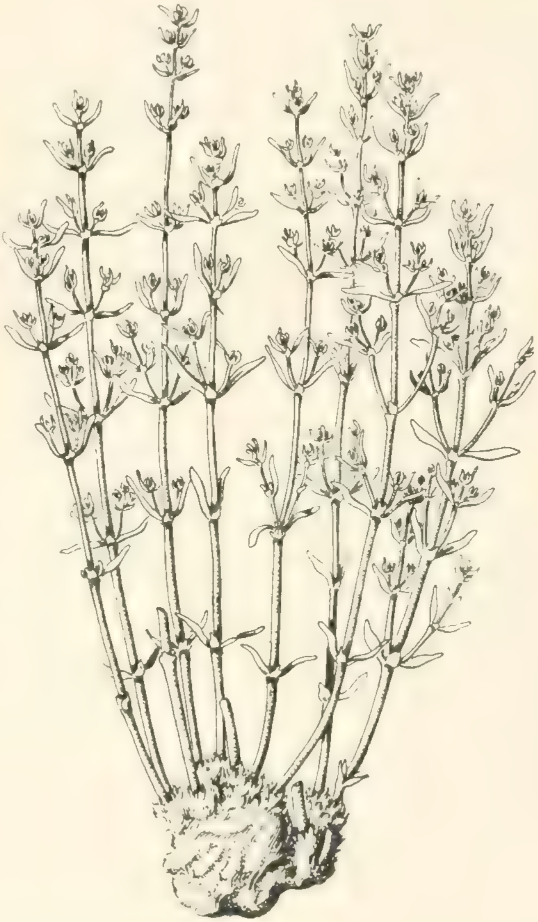

Fig. 100. EREMOLITHIA RIXFORDII Jepson; plant, x 1.

1. **E. rixfordii** Jepson n. comb. (Figs. 99b and 100.) Stems several, branching, strict, 3 to 5 inches high; leaves 2 to 4 lines long; calyx 1½ lines long, the staminodes as long as the calyx-lobes.

Rocky places, 4500 to 6000 feet, Inyo Co., eastward into southern Nevada.

Locs.—Owens Valley; Ash Mdws., Nev., *Purpus* 6032; Palmetto Range, Nev., *Purpus* 5843.

Refs.—EREMOLITHIA RIXFORDII Jepson. *Achyronychia rixfordii* Brandegee, Zoe, 1: 230 (1890), type loc. Owens Valley, *G. P. Rixford*.

14. **SCLERANTHUS** L.

KNAWEL.

Indifferent annuals with subulate leaves and no stipules. Flowers small, greenish, clustered. Petals none. Calyx deeply 5-lobed, the cup-like tube indurated and enclosing the utricle. Stamens 10 or 5. Ovary 1-ovuled. Styles 2, distinct.—Species 10, in all Old World lands. (Greek scleros, hard, and anthos, flower, referring to the hardened calyx-tube.)

1. **S. annuus** L. GERMAN KNOTGRASS. Stems much branched, spreading, 2 to 3 inches long; flowers 1 to 1½ lines long, sessile in the forks; calyx 1½ lines long, its lobes narrowly scarious-margined.

Neighborhood of Placerville, *K. Brandegee*. Introduced from Europe.

Ref.—SCLERANTHUS ANNUUS L. Sp. Pl. 406 (1753), type European.

15. **VACCARIA** Medic.

Glabrous glaucous annual with sessile leaves and showy red flowers in a broad loose flat-topped corymb. Calyx synsepalous, ovate, with 5 prominent angles. Petals 5, clawed, not appendaged. Stamens 10. Styles 2. Ovary 1-celled but with rudimentary partitions at base. Capsule ovate, dehiscent at apex by 4 short teeth.—Species 3, Europe, Asia. (Latin vacca, cow, some species used for fodder.)

1. **V. vulgaris** Host. COW-HERB. Strictly erect, dichotomously branching above, 2 to 3 feet high; leaves ovate or the upper lanceolate, 3 to 4 inches long with cordate-clasping base; flowers 7 to 9 lines long; petals red, the blade obcordate and claw linear.

Grain-field weed naturalized from Europe. Occurring rather widely in California but apparently not yet common.

Locs.—Dulzura, *I. Hagenback*, circa 1898; Berkeley, *Chesnut* in 1898; Sonoma (acc. *R. Kuhn* in 1914); College City, Colusa Co., *Alice King* in 1906; Plumas Co., *Platt* in 1891; Lundy, Mono Co., *Maud Minthorn.*

Refs.—VACCARIA VULGARIS Host, Fl. Austr. 1: 518 (1827); Jepson, Fl. W. Mid. Cal. 164 (1901). *Saponaria vaccaria* L. Sp. Pl. 409 (1753), type European.

16. **SAPONARIA** L. SOAPWORT.

Ours a stout perennial. Flowers white, in corymbed clusters. Calyx cylindric. Petals with a crest of 2 subulate teeth. Otherwise similar to Vaccaria.—Species about 20, northern hemisphere of the Old World. (Latin sapo, soap, the mucilaginous juice with saponaceous qualities.)

1. **S. officinalis** L. BOUNCING BET. Erect, 2 to 3 feet high, glabrous; leaves ovate, acute, 3 to 4 inches long; blade of petals cuneate-obovate, notched at apex, 6 to 7 lines long.

Garden plant, native of Europe, spontaneous on sandbars of the Sacramento River below Delta, *Jepson* 6183.

Refs.—SAPONARIA OFFICINALIS L. Sp. Pl. 408 (1753), type European; Müller, Fl. Dan. 4: 543 (1827).

17. **VELEZIA** Loefl.

Annuals with tough dichotomous stems and sparse foliage. Flowers pink, solitary in the axils of the subulate leaves, or in clusters of 2 or 3, divaricately divergent from the stem, borne on short peduncles or sessile. Calyx slender, elongated-cylindric, 15-ribbed, sharply 5-toothed. Petals small, with minute filiform crests, the blade in ours notched. Stamens 5. Styles 2. Capsule slender, terete, 4-valved at the summit.—Species 4, Mediterranean region. (Cristobal Velez, friend of Loefling.)

1. **V. rigida** L. Stems slender, trailing, 4 to 8 inches long, in age readily breaking up at the joints; herbage glandular-puberulent; leaves subulate, 2 to 6 lines long; blade of petals 1 line long; capsule sheathed by the calyx, 6 to 7 lines long; seeds laterally meniscoid.

Introduced from the Mediterranean region and locally established.

Locs.—La Grange, Sierra Nevada foothills, *Jepson* in 1896; Hupa Valley, Humboldt Co., *Jepson* 2120 in 1902.

Ref.—VELEZIA RIGIDA L. Sp. Pl. 332 (1753), type from s. Europe.

18. **SILENE** L. CATCH-FLY. CAMPION.

Annual or perennial herbs, more or less viscid and mostly large-flowered. Calyx tubular or inflated, 5-toothed. Petals 5, with long claws; junction of the claw and blade commonly furnished with 2 scales; blades spreading, entire, or more commonly cleft or laciniate. Stamens 10. Styles 3, rarely 4. Capsule opening by 3 or 6 teeth at apex.—Species 300, all continents except South America and Australia. (Greek sialon, saliva, the stems and other parts viscid.)

- Calyx-ribs conspicuous, about 20 nerved; annual..........................1. *S. multinervia.*
- Calyx 10 nerved, the nerves sometimes weak or obscure.
  - Annuals.
    - Internodes not glandular; flowers in one-sided racemes...............2. *S. gallica.*
    - Upper internodes with a glandular black band; flowers in cymes or panicles....... 3. *S. antirrhina.*
  - Perennials.
    - *Flowers large,* mostly ¾ to 2 inches broad (except no. 7); petals 4 to 6-cleft; stems leafy; mostly low altitudes (except no. 7).
      - Corolla crimson.
        - Plants 2 to 5 feet high; corolla ½ to ¾ inch broad.........4. *S. laciniata.*
        - Plants mostly ½ to 1 foot high; corolla 1 to 1½ inches broad............. 5. *S. californica.*
      - Corolla white, yellowish or pink; plants mostly 3 to 7 inches high.
        - Herbage grayish; corolla much exserted....................6. *S. hookeri.*
        - Herbage dull or yellowish green; corolla scarcely exserted...7. *S. parishii.*
    - *Flowers smaller,* mostly 3 to 6 (or 10) lines broad.
      - Flowers solitary in the upper axils or terminal, the stems very leafy throughout.
        - Calyx broadly turbinate-campanulate; flowers nodding on deflexed pedicels; petals 4 to 6-cleft..........................8. *S. campanulata.*
        - Calyx broadly oblong; flowers erect; petals notched, the lobes divergent..... 9. *S. menziesii.*
      - Flowers mostly scattered in a naked panicle or rarely solitary; stems mostly leafy at base or on lower part.
        - Flowers nodding or mostly so; stamens and style long-exserted.
          - Petals 4-cleft....................................10. *S. lemmonii.*
          - Petals 2-cleft....................................11. *S. bridgesii.*
        - Flowers erect or mainly so; stamens and style included or little exserted.
          - Mostly of middle altitudes or on the sea coast.
            - Calyx campanulate, cleft to the middle or nearly, about ½ as long as the corolla; petals 4-toothed; scales none..12. *S. aptera.*
            - Calyx toothed at summit, its teeth relatively short; scales present.
              - Calyx narrowly cylindric.
                - Auricles none or feebly developed; scales long-lanceolate, entire.
                  - Petals 4-cleft; capsule long-stiped..13. *S. occidentalis.*
                  - Petals 2-cleft; capsule sessile.......14. *S. pectinata.*
                - Auricles present; scales various; capsule stiped.
                  - Petals 4-cleft; scales laciniate or fimbriate.
                    - Ovary with minute valvular cap; claws glabrous; leaves mostly 2 to 6 lines broad........ 15. *S. montana.*
                    - Ovary with conspicuous valvular cap ⅕ as long as the ovary; claws woolly; leaves mostly ½ to 1 line broad........... 16. *S. bernardina.*
                  - Petals 2-cleft; scales entire or toothed, not fimbriate; claws woolly.............17. *S. verecunda.*
              - Calyx oblong-campanulate; petals unequally 4-cleft; claws glabrous; sea coast.................18. *S. grandis.*
          - High montane, mostly above timber line; calyx broadly cylindric or oblong-campanulate.
            - Stems from a loosely branched crown.............19. *S. douglasii.*
            - Stems caespitose.
              - Leaves 2 to 3 lines broad...................20. *S. grayi.*
              - Leaves mostly 1 line broad.................21. *S. watsonii.*

1. **S. multinervia** Wats. Annual; stems erect, simple or branching from the base, 7 to 16 inches high; herbage pubescent throughout, viscid-glandular above; leaves linear to lanceolate, 1 to 2 inches long; flowers short-pedicelled in close terminal clusters on the unequal branches of the cymosely forked inflorescence, or on mostly long (3 to 15 lines) pedicels in the forks; calyx ovate, broadly so in fruit, 3 to 4 lines long, about 20-ribbed, the ribs strong and equally prominent; petal blades small, pink, 2-cleft with obtuse lobes,

without crests, not exceeding the subulate spreading calyx-teeth or very little; claws without auricles; capsule nearly sessile, ovate.

Coast region, Marin Co. south to Southern California.

Locs.—Mt. Tamalpais, *Michener & Bioletti;* Pt. Sur, *T. Brandegee;* Santa Inez Mts., *T. Brandegee;* Ojai Valley, *F. W. Hubby;* Santa Cruz Isl., *T. Brandegee;* Ramona, *Purpus;* Santa Catalina and Santa Cruz islands (Zoe, 1: 133).

Refs.—SILENE MULTINERVIA Wats. Proc. Am. Acad. 25: 126 (1890), type spms. from Jamul, San Diego Co., *Orcutt*, and Santa Cruz Isl., *Brandegee;* Brandegee, Zoe, 2: 121 (1891); Jepson, Fl. W. Mid. Cal. 164 (1901). *S. conoidea* Brandegee, Proc. Cal. Acad. ser. 2, 1: 202 (1888); Zoe, 1: 113 (1890); not L.

2. **S. gallica** L. WINDMILL PINK. Erect, simple to freely branched, 10 to 15 inches high, hirsute or hispidulous with spreading hairs; leaves spatulate-obovate, 1 to 1½ inches long; flowers in a mostly 1-sided raceme on very short (1 to 2 lines long) pedicels; corolla white or flesh-color, 3 to 4½ lines broad; petal blades obovate and entire, the scales small; ovary almost completely 3-celled.

Naturalized from Europe; everywhere in fields and along roadsides, the only common pink. Apr.-May. The petals are commonly twisted one-fourth round or nearly so, thus resembling the fans of a turbine windmill. Flowers not withering early in the morning.

Refs.—SILENE GALLICA L. Sp. Pl. 417 (1753), type from France; Jepson, Fl. W. Mid. Cal. 165 (1901). *S. anglica* L. Sp. Pl. 416 (1753).

S. DICHOTOMA Ehrh. Beit. 7: 143 (1792). Tall, pubescent; leaves lanceolate or oblanceolate, acute; flowering stems forking, one flower in each fork, the others racemose; corolla pure white, vespertine, 6 to 8 lines broad; petal blades bifid.—European plant once adventive at Berkeley (Fl. Fr. 116) but not collected in recent years.

3. **S. antirrhina** L. SLEEPY CATCHFLY. Stems erect, slender, sparingly branched, 1 to 2½ feet high; herbage minutely puberulent below, mainly glabrous above, the upper internodes with a black glandular band at the middle; leaves oblong-lanceolate or linear, 1 to 2 inches long; inflorescence paniculate; pedicels 3 to 6 lines long, filiform; flowers small; petals pink or red, emarginate, the blade 1 line long; crests minute; capsule ovoid, 3 lines long.

Sandy soil. Throughout California, but nowhere common.

Locs.—Bakersfield, *Davy* 1863; Yosemite, acc. *Hall;* McCowin's Bridge, Calaveras Co., *Blasdale;* Egg Lake, Modoc Co., *M. S. Baker;* Sisson, *Jepson;* Buck Mt., Humboldt Co., *Tracy* 2801; Elk Mt., Lake Co., *Jepson;* Scotts Valley, Lake Co., *Tracy* 1732; St. Helena, *Jepson;* Redwood Cañon, Marin Co., *Michener & Bioletti;* Clayton, *Chesnut & Drew;* Big Sur River, *Davy* 7442; Arroyo Grande, *Alice King;* Palm Cañon, San Jacinto Mts., *Jepson* 1367; Witch Creek, *Alderson;* San Diego, *Orcutt;* Santa Catalina, Santa Cruz and San Miguel islands (Zoe, 1: 133).

Refs.—SILENE ANTIRRHINA L. Sp. Pl. 419 (1753), type spms. from Va. and Carolina; Jepson, Fl. W. Mid. Cal. 165 (1901).

4. **S. laciniata** Cav. Stems branching from the base, stiffly erect or climbing amongst bushes, knotty below, 2 to 5 feet high; herbage finely scabrous-puberulent and a little glandular; leaves elongated and narrowly lanceolate, or linear-lanceolate, and acute, sometimes varying to obovate, 2 to 6 inches long, narrowed to a sessile base; flowers terminal on the branches of a naked panicle, sometimes in clusters, crimson, ½ to ¾ (or 1) inch broad; calyx cylindric, 8 to 9 lines long, its obtuse teeth 1 line long; petals narrow, deeply 4-cleft into lanceolate divisions; crests erect, denticulate; capsule oblong, usually exserted at maturity.

Southern California from the coast inland to the San Jacinto Range, ascending in the chaparral to 3500 and 5300 feet; north along the coast to San Luis Obispo, Monterey, and Santa Cruz cos. In the Santa Cruz region it apparently overlaps the southerly extension of S. californica. South into Mexico and east to New Mexico.

Locs.—San Diego, *T. Brandegee;* Augustine's Ranch, Palomar, *Jepson* 1548; Mt. San Jacinto, *Geo. F. Reinhardt;* San Bernardino foothills, *Parish;* Santa Monica Mts., *Barber;* Santa Cruz Isl., *Frida Sexauer;* Ojai Valley, *F. W. Hubby;* Arroyo Grande, *Alice King;* Santa Cruz Co. (acc. Anderson, Nat. Hist. Santa Cruz, 36).

Refs.—SILENE LACINIATA Cav. Ic. 6: 44, t. 564 (1801), type loc. Mexico; Lindl. Bot. Reg. t. 1444 (1831). *S. simulans* Greene, Pitt. 1: 63 (1887), type spms. from Santa Cruz and San Miguel islands; (cf. Zoe, 1: 133).

5. **S. californica** Dur. INDIAN PINK. (Fig. 101.) Stems 1 or several from a stout taproot, erect or half-erect, very leafy, ½ to 1 foot high or reclining amongst bushes and up to 3⅔ feet high; herbage puberulent and more or less glandular; leaves elliptic-ovate or ovate to oblanceolate, more or less abruptly acuminate, 1 to 3½ inches long; pedicels ½ to 1½ inches long; calyx oblong, soon turbinate- or obovate-distended, 7 to 11 lines long, its teeth lanceolate; corolla crimson, 1 to 1¼ inches broad; petals deeply 4-cleft, the middle segments the longer, all the segments toothed, or the lateral entire or rarely all entire; scales 2 to 4, conspicuous, incurved; capsule obovoid, 6 to 8 lines long, not exceeding the broad calyx; seeds regularly papillate, the papillae with a depression in the center.

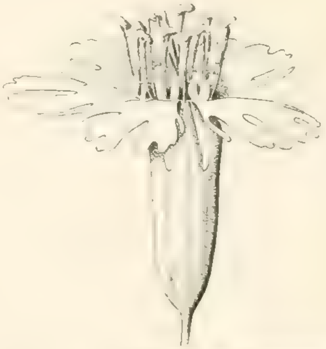

Fig. 101. SILENE CALIFORNICA Dur.: flower, x 1½.

Open woods of cañons: Sierra Nevada; Tehachapi Range; Coast Ranges from Del Norte Co. at least as far south as Santa Clara and Santa Cruz cos. Our most widely distributed native species in central and northern California. Extends into the corner of southwestern Oregon. June.

Locs.—Red Hill, Del Norte Co., *Jepson* 2904; Tehama Co., *Jepson;* Redwood Creek, Humboldt Co., *Jepson* 1962; Cahto, Mendocino Co., *Jepson;* Comptche, *Harriet Walker* 387; Mt. Konocti, *Jepson;* Cache Creek Cañon, *C. F. Baker* 2978; Howell Mt., *Tracy* 2208; Berkeley Hills, *Davy;* Lake Pilarcitos, *Davy* 1158; Loma Prieta, *Davy* 272. Sierra Nevada, 2000 to 5000 feet: Morley's Sta., Shasta Co., *M. S. Baker;* Spanish Peak, Plumas Co., *R. M. Austin;* Blue Cañon, *Harriet Walker* 1253; Middle Tule River, *Jepson* 4863; San Emigdio Cañon, *Davy* 2067.

Refs.—SILENE CALIFORNICA Dur. Jour. Acad. Phil. ser. 2, 3: 83 (1855), type loc. Deer Creek, Nevada City, *Pratten;* Jepson, Fl. W. Mid. Cal. 165 (1901). Var. *subcordata* Rob. Leaves suborbicular, shortly acuminate, the subcordate base sessile.—Blue Cañon (acc. Syn. Fl. 1^1: 218).

6. **S. hookeri** Nutt. Stems several, 3 to 5 inches high, erect or decumbent, arising from slender rootstocks derived from the crown of a perennial taproot; herbage grayish pubescent or glabrate; leaves obovate to oblanceolate, attenuate at base, acute at apex, 1 to 2 inches long; flowers few, solitary in the upper axils, or often only a single terminal one; calyx at first clavate-tubular, 8 to 10 lines long, 1½ to 2 lines broad, its lanceolate teeth ¼ as long as the tube; calyx in age strongly turbinate, becoming 4 lines broad; corolla white or pink, 1 to 2 inches broad; petals deeply slashed into 4 laciniate or linear entire or cleft lobes; crests conspicuous, only the very tips free, entire or notched; capsule globose-ovate.

Open woodlands. Mendocino Co. north to western Oregon. May-June.

Locs.—Willits, *Davy* 5096; Cahto, *Jepson* 1853; Long Valley, Mendocino Co., *Bolander* 4696; Graham's, Humboldt Co., *Blasdale;* Klamath River, Humboldt Co., *Chandler* 1539. Myrtle Creek, Ore., *Patsy Ann Wiley.*

Refs.—Silene hookeri Nutt.; T. & G. Fl. 1: 193 (1838), type loc. woods of the Willamette, Ore., *Gardiner;* Hook. f., Bot. Mag. t. 6051 (1873).

7. **S. parishii** Wats. Stems several from the slender branching crown of a fleshy taproot, 4 to 7 or 10 inches high; herbage including the calyx densely pubescent; leaves narrowly or sometimes broadly lanceolate to oblanceolate, acuminate, ¾ to 1¼ inches long; flowers in terminal 1 to 4-flowered clusters; calyx yellowish, broadly cylindric, 8 to 11 lines long, the lanceolate teeth 2 to 3 lines long; corolla white or lemon-yellow, little exserted from the calyx, about 5 to 7 lines broad, the blades of the petals cut nearly to base into about 4 narrowly lanceolate or subulate segments, with a supplementary tooth on each side at base; seeds with a double marginal crest of flattened tubercules.

Among rocks or in loose granitic soil in pine forest: San Bernardino and San Jacinto mountains, 8000 to 11,000 feet.

Locs.—Near Mt. San Gorgonio, *Blasdale;* Santa Ana Cañon, San Bernardino Mts., *Hall* 7680; Tauquitz, Mt. San Jacinto, *Jepson* 2303; Santa Rosa Peak, *Jepson & Hall.*

Refs.—Silene parishii Wats. Proc. Am. Acad. 17: 366 (1882), type loc. San Bernardino Mts., *S. B. & W. F. Parish;* Merritt, Erythea, 4: 147 (1896).

8. **S. campanulata** Wats. Stems erect, leafy, many from the thick crown of a perennial taproot, 9 to 11 inches high; herbage green, finely glandular-puberulent to glabrous; leaves oblanceolate to ovate, acute to acuminate, sessile, ¾ to 1 inch long; flowers racemose, on deflexed pedicels 3 to 4 lines long; calyx broadly campanulate, 4 to 6 lines long, its broad rounded teeth ⅓ to ½ as long as the tube; petals greenish white or flesh-tinted, 4 to 6-cleft into linear lobes, the lobes 2-cleft at apex; auricles broad; scales well developed, several cleft and toothed.

North Coast Ranges from northern Mendocino to Humboldt Co. North to southern Oregon.

Locs.—In the matter of leaf breadth, the typical form of the species exhibits rather narrow or lanceolate leaves, while the var. greenei Wats. has ovate leaves. Since narrow and broad leaves may, however, occur in one set of individuals, leaf breadth is evidently not of varietal importance. Both narrow and broad leaf forms, moreover, are represented by glandular-puberulent and by glabrous individuals. On the other hand the species is not to be regarded as strictly monotypic, and the specimens before us may be more consistently segregated in the following way. **Typical:** Finely glandular puberulent, leaves varying in breadth from oblanceolate to ovate.—Red Mt., *Bolander* 6517; Mad River, Humboldt Co., *Blasdale;* Cudahay Valley, w. Siskiyou, *Jepson* 2855; Humbug road, Siskiyou, *Butler* 772. Var. **greenei** Wats. Finely and often rather densely pubescent to glabrous, but not at all or scarcely glandular.—Highland Mine, *Butler* 962 (finely pubescent, leaves ovate); Shackleford Cañon, *Chandler* 1715 (glabrous, leaves lanceolate); Log Lake, w. Siskiyou, *Butler* 59 (glabrous, leaves ovate). Var. **petrophila** Jepson n. var. Stems and leaves puberulent, not glandular, glaucous; leaves ovate; petals pale yellow.—(Caules foliaque puberulenta glauca, non glandulosa; folia ovata; petala flava.)—Rocky ridge near Salmon Summit, *Jepson* 2076a.

Refs.—Silene campanulata Wats. Proc. Am. Acad. 10: 341 (1875), type loc. Red Mt., n. Mendocino, *Bolander* 6517, *Kellogg.* Var. greenei Wats. in Rob. Proc. Am. Acad. 28: 137 (1893), type spms. from Yreka, Cal., and s. Ore. Var. *orbiculata* Rob. in Gray, Syn., Fl. 1^1: 219 (1897), type loc. Hettenchow, Trinity Co., *Blankinship.* Leaves roundish, shortly acuminate, ½ inch broad; herbage tomentulose.—Ex. char.

9. **S. menziesii** Hook. Stems slender, erect, very leafy, 3 to 11 inches high, arising from slender branching rootstocks derived from a perennial root; herbage puberulent; leaves obovate to oblanceolate, tapering to base, acute or short-acuminate at apex, ½ to 1½ inches long; flowers few in the axils of the reduced upper leaves, on pedicels 4 to 6 (or 15) lines long; calyx oblong, 2 to 3 lines long; corolla 3 to 4 lines broad; petals narrowly fan-shaped, deeply and broadly notched, with or without small lateral teeth; claws without crests or with small ones.

Sierra Nevada, 3000 to 9000 feet, south to the San Bernardino Mts., north to Modoc Co., thence west to Humboldt Co. Far north to British America, east to Missouri. Strongly resembling Arenaria macrophylla.

Locs.—Hyampum, Humboldt Co., *Chesnut & Drew;* McCloud River near Bartles, *M. S. Baker;* Sugarloaf Hill, Modoc Co., *R. M. Austin;* Lassen Creek, *R. M. Austin;* Tuolumne Soda Springs, *Chesnut & Drew;* upper San Joaquin, Madera Co., *Congdon;* Bubbs Creek, *Jepson* 799; Junction Mdw., Kern River, *Jepson* 5018; Bear Valley, San Bernardino Mts., *Hall.*

Ref.—SILENE MENZIESII Hook. Fl. Bor. Am. 1: 90, t. 30 (1830), type spms. from Northwest America.

10. **S. lemmonii** Wats. (Fig. 102a.) Stems slender, erect, very leafy at base, 8 to 14 inches high, arising from the slender branched rootstocks crowning a deep-seated taproot; herbage puberulent and somewhat glandular; basal leaves narrowly obovate, acute, narrowed at base, ¾ to 1¼ inches long; stem leaves similar or linear or lanceolate, the upper remote and much reduced; flowers nodding, in a narrow few-flowered panicle; calyx 3 to 3½ lines long, oblong (soon turbinate-distended by the ovoid capsule), scarious, with 10 green nerves, the alternate ones ending in the short rounded teeth; corolla dull or pale yellowish white, 4 to 6 lines broad; blade of petals 4-cleft into linear-subulate segments, the segments entire or rarely lobed; scales entire or 2-toothed, erect; auricles broad, rounded; claws woolly-pubescent; stamens long-exserted, twice as long as the corolla.

Open pine forest, 4000 to 6500 feet, Sierra Nevada. The most common species in the coniferous belt.

Biol. Note.—The flowers open in the evening, the petal blades stiffly spreading, at first reflexed, later rotate; during the next morning the segments coil inwards from the tip, remain closely coiled all day and do not, so far as we have observed, uncoil again. The stamens are physiologically in 2 sets of 5 each: the first set becomes long-exserted, the second set meanwhile remaining coiled at mouth of calyx tube; when the first 5 relax, the second 5 elongate; the flowers are protandrous and the very long styles follow the second set of stamens or overlap them somewhat during the latter part of their period of anthesis. The procedure in this species probably does not differ essentially in the related species.

Locs.—Sierra Nevada: Egg Lake, Modoc Co., *M. S. Baker;* ne. Shasta Co., *Hall & Babcock* 4126; Lassen Peak, *Jepson* 4096; Mt. Harkness, Plumas Co., *Jepson* 4122; Blue Cañon, Placer Co., *Harriet A. Walker* 1233; Fallen Leaf Lake, *M. S. Baker;* Yosemite Valley, *Jepson* 4260; Little Yosemite, *Jepson* 3162; Chilnualna Creek, Mariposa Co., *Congdon;* Hazel Green to Big Meadows, *Jepson;* Pine Ridge, Fresno Co., *Hall & Chandler* 70; Round Mdw., Giant Forest, *Jepson* 706. North Coast Ranges: Sisson, *Jepson;* Dyer's Ranch to Hawkins Bar, Trinity Co., *Jepson* 1990; Snow Mt., *T. Brandegee.* Southern California: Mt. Wilson, *Geo. B. Grant;* Job's Peak, San Bernardino Mts., *Parish* 2336; Seven Oaks, *Parish* 3729; Cuyamaca Mt., *T. Brandegee.*

Refs.—SILENE LEMMONII Wats. Proc. Am. Acad. 10: 342 (1875), type loc. Sierra Co., *Lemmon.* *S. palmeri* Wats. l. c. 11: 124 (1876), type loc. Cuyamaca Mts., *Palmer.* *S. longistylis* Engelm.; Wats. l. c. 22: 469 (1887), type spms. from Scott Mts., Cal., *Engelmann,* and Ashland Butte, Ore., *Henderson.* *S. deflexa* Eastw. Bot. Gaz. 41: 284 (1906), type loc. "above the lakes," Cañon Creek, Trinity Co., *Vernon Bailey.*

11. **S. bridgesii** Rohrb. Stems 1 to 4 from the crown of a taproot, leafy, 1½ to 2½ feet high; herbage glandular-puberulent; leaves sessile, lanceolate to oblanceolate, acute or acuminate, sometimes varying to oblong-lanceolate, 1 to 2½ inches long; flowers nodding, verticillately racemose or in a narrow loose panicle with spreading branches; calyx nearly cylindric, soon clavate or obovate in fruit, 3 to 5 lines long, the teeth acute or lanceolate, ¼ to ⅓ as long as the tube; corolla white or purplish, 5 to 8 lines broad; petal blades 2-cleft into linear segments; crests lanceolate; stamens and style long exserted; capsule ovate-globose.

Central and southern Sierra Nevada, 4000 to 8700 feet.

Locs.—Near Jackson, *Hansen* 525; Rosasco's, Tuolumne Co., *Chesnut & Drew;* Yosemite Valley, *Bioletti;* Snow Creek, Mariposa Co., *Congdon;* Sequoia Mills (now Millwood), *T. Brandegee;* Old Colony Mill, Sequoia Park, *Jepson* 629; North Middle Tule River, *Purpus* 5596.

Refs.—Silene bridgesii Rohrb. App. Ind. Sem. Berol. 1867, 5, type from "California, *Bridges";* Monog. Gatt. Silene, 204 (1868). *S. incompta* Gray, Proc. Am. Acad. 7: 330 (1868), type spms. from Mt. Bullion and Yosemite, *Bolander.*

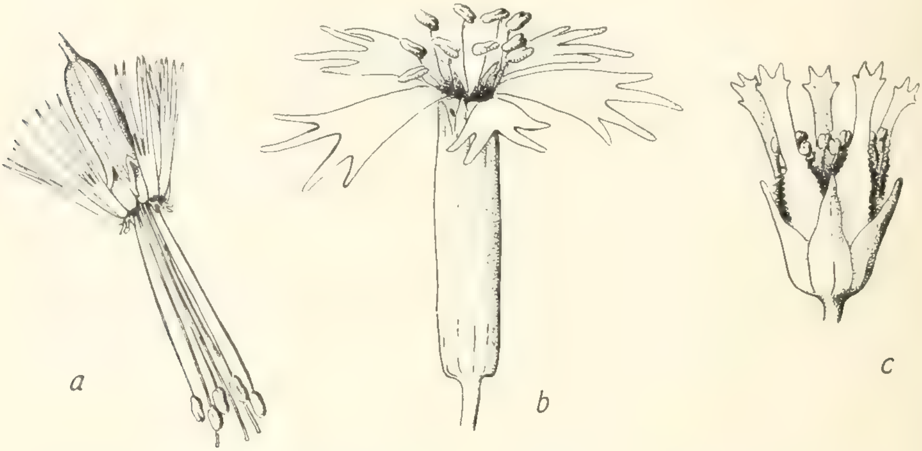

Fig. 102. *a,* Silene lemmonii Wats., flower. *b,* Silene occidentalis Wats., flower. *c,* Silene aptera Greene, flower. Drawn from dried specimens. x 2.

12. **S. aptera** Greene. (Fig. 102c.) Stems very slender, erect, 9 to 14 inches high, one or several from the condensed crown of a taproot, the leaves chiefly basal, the stems with mostly a single pair at or near the middle; herbage minutely pubescent; leaves linear or linear-subulate, 1½ to 3¼ inches long, ½ to 1¼ lines wide; stems 1-flowered, or few-flowered and loosely cymose; calyx campanulate, 3½ to 4½ lines long, cleft to the middle or below into lanceolate acute scarious-margined lobes; corolla nearly twice as long as the calyx, 5 to 7 lines broad; petal blades shallowly 4-notched or -lobed, the broad claws hairy-tomentulose; scales and auricles none; capsule oblong, exceeding the calyx.

Hockett Meadows, Tulare Co., 8500 to 9000 feet. A distinct species with ampler characters than hitherto indicated.

Ref.—Silene aptera Greene, Leaflets, 1: 75 (1904), type loc. Hockett Meadows, *Culbertson,* July 16, 1904.

13. **S. occidentalis** Wats. (Fig. 102b.) Stems erect, 13 to 19 inches high, 1 to 4 from the crown of a stout taproot; herbage viscid-glandular; basal and lower leaves narrowly obovate or oblanceolate, acute, narrowed gradually at base into a long slender margined petiole, 2 to 4½ inches long, the upper linear or lanceolate, acuminate, 1 to 2 inches long; flowers terminal on the forks of a loosely branched panicle; calyx narrowly tubular or soon slightly distended above the middle, 6 to 9 lines long, its teeth obtuse; corolla purple or dull white, 6 to 10 lines broad; petal blades cuneate, cleft half way into 4 or 5 linear or lanceolate segments; claws without teeth or auricles; scales linear or lanceolate, nearly entire; capsule oblong-cylindric, 5 to 6 lines long, on a stipe 2 lines long.

Northern Sierra Nevada, 4400 to 6000 feet, from Alpine Co. north to Modoc Co.; Tulare Co., southern Sierra Nevada. The pedicels of the lateral flowers are mostly 3 to 8 or 12 lines long, while in S. pectinata and S. montana the lateral flowers are usually on shorter pedicels or often subsessile.

Locs.—Upper Clover Creek, Shasta Co., *M. S. Baker* 316; Silver Lake, Modoc Co., *M. S. Baker;* Prattville, *T. Brandegee;* Plumas Co., *Platt;* Cisco, *Hall* 8709; Tallac, *C. J. Fox, Jr.*

Var. **nancta** Jepson n. var. Panicles loose, broad, with white flowers; blade of the petals cut into 2 divergent lanceolate lobes, each with one small lateral tooth; scales lanceolate, very long, entire. (Panicula laxa lata; flores albi; petalorum lamina bifida, lobis divergentibus laterale 1-dentatis; squamae lanceolatae longissimae integrae.)—Hockett Mdw., Tulare Co., *Jepson* 4685.

Ref.—SILENE OCCIDENTALIS Wats. Proc. Am. Acad. 10: 343 (1875), type loc. Sierra Co., *Lemmon.*

14. **S. pectinata** Wats. (Fig. 103a.) Stems erect, $1\frac{1}{2}$ to $2\frac{1}{2}$ feet high, 1 or 2 (or several) from the crown of a stout taproot, the leaves in a coarse tuft at base or the lower part of the stem with a few remote pairs; herbage very gummy or glandular-pubescent; leaves elliptic-ovate to lanceolate, acute or acuminate, 2 to $3\frac{1}{2}$ inches long; flowers erect, few in a narrow or rather strict panicle; calyx cylindric, soon turbinate-distended or ovoid, 5 to 6 lines long, the teeth long-lanceolate, $\frac{1}{3}$ to $\frac{1}{2}$ as long as the tube and usually exceeding the mature capsule; corolla deep red, 6 to 8 (or 9) lines broad; petal blades cuneate, broadly notched, with rounded lobes; scales lanceolate or subulate, entire or notched; capsule ovoid, sessile or nearly so, 3 to 4 lines broad.

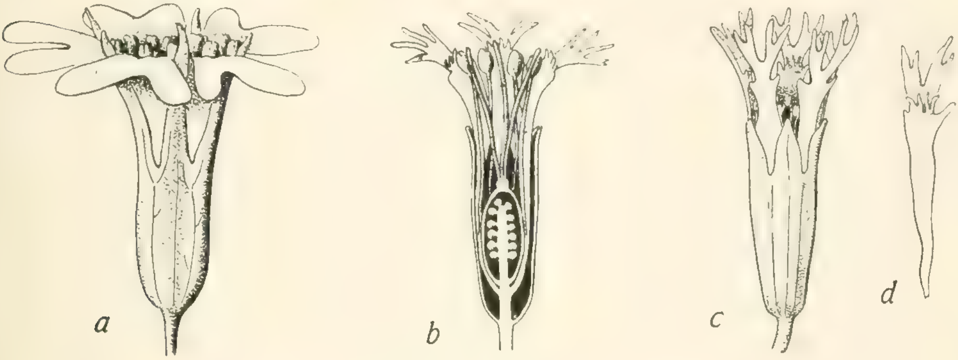

Fig. 103. *a*, SILENE PECTINATA Wats., flower. *b*, SILENE MONTANA Wats., longitudinal median section of a flower showing the petals, stamens and ovary raised on a stipe. *c*, SILENE BERNARDINA Wats., flower; *d*, petal. Drawn from dried specimens. x 2.

Eastern slope of the northern Sierra Nevada, 2500 to 4500 feet, from Mono Co. to Lassen Co., thence westerly on the interior plateau to northeastern Shasta Co. Adjacent Nevada.

Locs.—Upper Fall River Valley, *Jepson* 5762; Honey Lake, *T. Brandegee;* Sierra Valley, *Lemmon;* Sonora trail, 14 miles east of summit, *Brewer* 1875. King's cañon, Ormsby Co., Nev., *Baker* 1103.

Refs.—SILENE PECTINATA Wats. Proc. Am. Acad. 10: 344 (1875), type spms. said to be from near Carson City, Nev. *(C. L. Anderson)*, Walkers Meadows (*Brewer* 1857), and Plumas Co. *(M. P. Ames, Lemmon)*. We have no specimens from the western slope of the Sierra Nevada.

15. **S. montana** Wats. (Fig. 103b.) Stems several to many, erect, 9 to 16 inches high, from the branching crown of a taproot; herbage puberulent, glandular above; leaves narrowly linear-lanceolate or -oblanceolate, 1 to $2\frac{1}{4}$ inches long; flowers in a spicate panicle; calyx cylindric, soon clavate-distended, 6 to 7 lines long, its short teeth very acute and narrowly scarious-margined; corolla greenish white to rose, 4 to 7 lines broad; petal blades cut at apex into 4 (or 6) narrow segments; scales 2, fimbriate or toothed; auricles roundish, commonly denticulate; filaments scarcely exserted; capsule slender-cylindric, tapering to apex, 4 to 5 lines long, included, its stipe $1\frac{1}{2}$ to 2 lines long.

Sierra Nevada and desert region adjoining on the east, 4000 to 6500 feet; inner North Coast Range.

Locs.—Janesville, *T. Brandegee*; Lake Tahoe, *Blasdale*; Crane Creek, Yosemite Park, *Jepson* 4646; Mineral King, *Hall & Babcock* 5586. Mt. Hull, Lake Co., *Hall* 9540.

Refs.—SILENE MONTANA Wats. Proc. Am. Acad. 10: 343 (1875), type spms. from Carson City, *Anderson*, and Big Meadows, Plumas Co., *Lemmon*. *S. shockleyi* Wats. l. c. 25: 127 (1890), type loc. White Mts., Mono Co., *W. H. Shockley*, a synonym acc. Robinson in Gray, Syn. Fl. 1^1: 220.

16. **S. bernardina** Wats. (Fig. 103c, d.) Stems erect, densely leafy at base, 7 to 15 inches high, several to many from the loosely branching crown of a stout taproot or sometimes caespitose; herbage dark green, glandular-puberulent throughout, or often grayish pubescent below; leaves grass-like, narrowly linear- or subulate-lanceolate, acuminate, 10 to 16 lines long, $\frac{1}{2}$ to 1 (or 2) lines wide; flowers in a narrow panicle; calyx cylindric, at length turbinate-distended, 6 lines long, its teeth broadly lanceolate, acute, scarious-margined, 1 to $1\frac{1}{2}$ lines long; corolla white, nearly half longer than the calyx, 3 to 4 lines broad; petal blades 4-cleft, or deeply 2-cleft with the divergent lobes again 2-cleft to middle; claws commonly sparingly woolly on lower part; scales long, laciniate nearly or quite to the base; auricles rounded or lanceolate; capsule ovoid, $3\frac{1}{2}$ to 4 lines long, long-stiped.

Southern Sierra Nevada, 5000 to 8000 feet.

Locs.—Kearsarge Mill (below Kearsarge Pass), *Jepson* 901; Tulare Co., *Hall & Babcock* 5558 (Kern Cañon at East Fork), 5343 (Coyote Meadows), 5142 (Salmon Creek).

Ref.—SILENE BERNARDINA Wats. Proc. Am. Acad. 24: 82 (1889), type loc. Long Meadow, south of Mt. Whitney, *Palmer* 185. The specific name used by Watson is inexplicable.

17. **S. verecunda** Wats. (Fig. 104a.) Stems erect or decumbent, several from the branching crown of a stout taproot, leafy along the lower part of the stem and also very leafy at base, $\frac{1}{2}$ to 1 foot high; herbage finely pubescent below, glandular-viscid above; leaves linear-lanceolate, acuminate; flowers in 1 to 3-flowered peduncled clusters scattered along the simple or sparingly branched flowering stems, the pedicels short and stout; calyx densely pubescent and also glandular, cylindric, 5 to 6 lines long, or becoming clavate or obovate as the fruit develops; corolla rose-color, 4 to 6 lines broad; petal blades cleft to the middle into 2 entire or slightly toothed oblong lobes, and with 2 nearly obsolete lateral lobes or rounded teeth; scales broadly oblong, obtuse or often notched; claws woolly pubescent; auricles rounded; capsule ovoid, slightly exserted, sessile or stiped; seeds papillate, the papillae developed into a crest on the margin.

South Coast Ranges. May-Sept. The stipe is very variable in length.

Locs.—Lone Mt., San Francisco, *Chandler*; Presidio, San Francisco, *Jepson, Tidestrom*. Only the plants of the San Francisco peninsula are truly typical. The plant on Mt. Diablo *(Greene)* seems different but we are unable to segregate it varietally. We lack material to define the limits southward but presumably the species must, at least provisionally, include the plants of San Luis Obispo Co. and of the southern coast stations as far as the Santa Ana Mts. There is a plant from Mt. Wilson *(Davidson)* which is remarkably canescent but too little known. A specimen from the summit of Mt. San Antonio, *Surr*, is more glandular than typical plants but strikingly like them. The remaining material before us, of the high ranges and mostly away from the coast, is very different in aspect from the type, but careful dissections and comparison of field notes fail to give any constant characters for specific separation, a dilemma which previously confronted Robinson (in Gray, Syn. Fl. 1^1: 221). While it is thus confessedly difficult to locate a definite break in the series, the differences in habit seem, however, somewhat related to the geographical distribution and the montane material is here taken as constituting a form of varietal status:

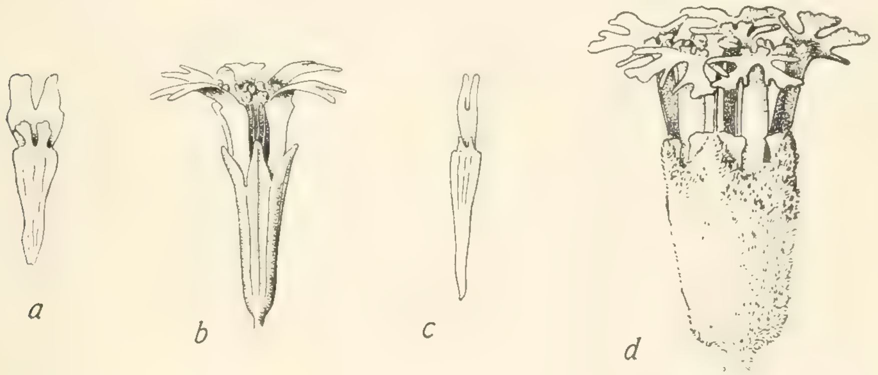

Fig. 104. *a*, SILENE VERECUNDA Wats., petal. *b*, var. PLATYOTA Jepson, flower; *c*, petal. *d*, SILENE GRANDIS Eastw., flower. x 2.

Var. **platyota** Jepson n. comb. (Fig. 104 b, c.) Stems slender, branching above and forming a mostly open panicle with scattered flowers on long pedicels or sometimes in 3-flowered short-peduncled clusters; basal leaves oblong- to linear-oblanceolate, narrowed at base to a margined petiole, 1½ to 4 inches long; calyx lightly pubescent; petals pink, purple, or (?) greenish white, very narrow; scales mostly lanceolate or linear; auricles rounded or acute.—High montane, 5000 to 9000 feet, mountains of Southern California to the southern Sierra Nevada.

Locs.—Cuyamaca Mts., acc. *Watson;* Mt. San Jacinto, *Jepson* 2313; Seven Oaks, San Bernardino Mts., *Parish* 3728; Lytle Creek Cañon, San Gabriel Mts., *Hall* 1242; Mt. Gleason, *Barber* 257; Pahute Peak, *Purpus* 5309; Collins Mdw., Fresno Co., *Hall & Chandler* 458.

Refs.—SILENE VERECUNDA Wats. Proc. Am. Acad. 10: 344 (1875), type loc. rocky hills near Mission Dolores, San Francisco, *Bolander* 352; Jepson, Fl. W. Mid. Cal. 165 (1901). *S. luisana* Wats. l. c. 23: 261 (1888), type spms. from San Luis Obispo, *Lemmon*, and Jolon, *T. Brandegee;* a synonym acc. Robinson in Gray, Syn. Fl. 1^1: 221. Var. PLATYOTA Jepson. *S. platyota* Wats. l. c. 17: 366 (1882), type spms. from Cuyamaca, San Jacinto and San Bernardino mountains.

18. **S. grandis** Eastw. (Fig. 104d.) Stems ¾ to 2 feet high, very stout, strongly thickened at the nodes, unbranched, densely leafy, bearing peduncled or subsessile clusters of flowers in the axils of the somewhat reduced upper leaves; stem leaves roundish-ovate, shortly acute, 1 to 2 or 3 inches long, sessile or drawn down to a margined petiole, the pairs connate-clasping by a broad base; basal leaves similar but long-petioled; calyx oblong-campanulate, 5 to 7 lines long, scarious between the green nerves, which are densely hairy or velvety, its teeth roundish, scarious margined; petal blades unequally 4-cleft, the two middle ones longer, truncate, toothed or shortly cleft, the lateral very small, lanceolate, strongly divergent; scales quadratish, truncate, toothed; claws glabrous; auricles narrow, rounded; capsule oblong, stipitate, slightly exceeding calyx.

Sea bluffs of Marin and Sonoma cos.

Locs.—Pt. Reyes, *Davy* 6876; Bodega Head, *K. Brandegee.*

Var. **pacifica** Jepson n. comb. Much more slender and less densely leafy; leaves narrower, the basal 2 to 3 inches long on petioles nearly twice as long; claws glabrous.—Sea coast, central and northern California. A transition to S. verecunda.

Locs.—San Francisco, *K. Brandegee;* s. Marin Co.; Bucksport near Eureka, *Tracy* 2141.

Refs.—SILENE GRANDIS Eastw. Bull. Torr. Club, 30: 487 (1903), type loc. Bodega Pt., *Eastwood.* Var. PACIFICA Jepson. *S. pacifica* Eastw. Bot. Gaz. 41: 285 (1906), type loc. Rodeo Lagoon, near Pt. Bonita, Marin Co., *Eastwood.*

19. **S. douglasii** Hook. var. **monantha** Rob. Stems erect, several from the loosely branching crown of a taproot, 10 to 20 inches high, the leaves chiefly basal, the stem with mostly 1 or 2 remote pairs; herbage very minutely pubescent or nearly glabrous, especially below; leaves linear-lanceolate to oblanceolate, tapering to both ends, 1 to 2½ inches long; stems (or the main branches) 1 or more commonly 3 to 5-flowered; calyx oblong-cylindric, soon inflated and oblong-campanulate, 6 to 7 lines long, its teeth roundish, often a little constricted at base, obtuse at apex or at length with the membranous margins inflexed and thus acute; corolla dull white, 5 to 8 lines broad; petal blades 2-cleft, its lobes entire; claws somewhat exserted; scales oblong, entire; auricles obtuse or acute; capsule elliptic or oblong, 4 to 5 lines long, included, on a stipe 1½ lines long.

Sierra Nevada, 6000 to 8000 feet, from Placer Co. north to Modoc Co., thence to western Siskiyou. North to Washington.

Locs.—Fallen Leaf Lake, *Hall* 8773; Cisco, Placer Co., *Hall* 8728, 8742; between Donner Lake and Coldstream, *Heller* 6957; Tallac, El Dorado Co., *C. J. Fox, Jr.;* Nevada Co., *Carpenter;* Lower Sardine Lake, Sierra Co., *Hall & Babcock* 4491; Dixie Valley, Lassen Co., *Baker & Nutting;* Mt. Bidwell, *Mary H. Manning;* Highland Mine, Siskiyou Co., *Butler* 963.

Specimens from Sierra, Placer and El Dorado counties in the northern Sierra Nevada are very uniform in habit save in number of flowers on the flowering stems. One finds specimens with the stems 3 or 5-flowered, rarely 7-flowered. Less commonly plants are found with all the stems 1-flowered, but frequently plants show all these variations on a single individual. In his revision of Silene, Williams, whose material was evidently scanty, disposes of S. monantha Wats., the type of which is simply the 1-flowered state, in the subgenus Gastrosilene and places S. douglasii Hook. (the many-flowered original form) in the subgenus Eusilene. In the absence of ample material a specific unit may thus be broken and separated, by applying too rigidly the characters of defined subgenera, which nevertheless may be sound in principle.

Refs.—SILENE DOUGLASII Hook. Fl. Bor. Am. 1: 88 (1829), type spms. collected above the Grand Rapids of the Columbia and on the western slope of the Rocky Mts. by *Douglas.* Williams, Jour. Linn. Soc. Bot. 32: 143 (1896). Var. MONANTHA Rob. Proc. Am. Acad. 28: 145 (1893). *S. monantha* Wats. Proc. Am. Acad. 10: 340 (1875), type loc. Castle Rock, Cascade Mts., Wash., *Kellogg & Harford.* *S. lyallii* Wats. at least as to Californian distributions.

20. **S. grayi** Wats. Stems erect, caespitose, 4 to 7 inches high, arising from the branching crown of a taproot; herbage finely puberulent, glandular above; leaves linear to oblanceolate, 5 to 8 lines long, mostly 2 to 3 lines broad, somewhat fleshy, densely crowded at base, the cauline pairs few and reduced; flowers 1 to 4 or 5, in a loose terminal cluster; calyx purplish, broadly cylindrical, soon ovoid-distended, 5 lines long, the teeth rounded; corolla pink, 3 to 4 lines broad; petal blades bifid, the segments each bearing a lateral tooth; scales lanceolate; auricles narrow, truncate; capsule obovoid, 4 to 5 lines long, the stipe almost none.

High montane, above timber line, 7000 to 8000 feet: Mt. Shasta to ne. Siskiyou, west to the Klamath Range.

Locs.—Medicine Lake Mts., *M. S. Baker;* Horse Camp, Mt. Shasta, *Jepson;* Mt. Eddy, *E. B. Copeland* 3853; near Preston Peak, *Jepson* 2882.

Refs.—SILENE GRAYI Wats. Proc. Am. Acad. 14: 291 (1879), type loc. Mt. Shasta, *Brewer, Hooker & Gray, A. S. Packard, Jr.;* Rob. Bot. Gaz. 16: 44, pl. 6, figs. 7, 8 (1891).

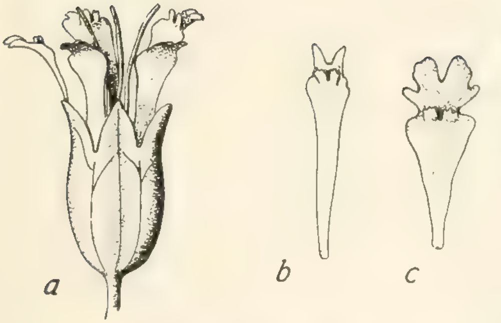

Fig. 105. Silene watsonii Rob. *a*, flower; *b*, petal; *c*, another petal, typical form. x 2.

21. **S. watsonii** Rob. (Fig. 105.) Flowering stems densely caespitose on the branched crown of a taproot, 3 to 5 inches high, nearly filiform; herbage glandular-puberulent; leaves mostly crowded at base, narrowly linear to narrowly oblanceolate, ¼ to 1½ inches long, rarely exceeding 1 line in breadth; flowering stems with 1 terminal flower or often with 1 to 3 lateral short-peduncled flowers racemosely scattered below the terminal flower, sometimes a lateral flower replaced by a 2-flowered cluster; calyx purplish, broadly cylindric or soon becoming obovate, 5 to 6 lines long, its teeth obtusish, scarious-margined; corolla white or rose-color, 4 to 6 lines broad; petal blades 1 to 2 lines long, bifid, the lobes obtuse, laterally short-toothed or entire; crests quadrate and obtuse, or 2-cleft; styles 3 (or 4), spirally twisted and exserted in anthesis; capsule cylindric-ovoid.

Above timber line, Sierra Nevada, 6500 to 12,000 feet, to Siskiyou Co. North to Oregon.

Locs.—Long Lake, Plumas Co., *Hall* 9349; Pyramid Peak, *Hall & Chandler* 4720; Macomb Ridge, Yosemite Park, *Jepson* 4559 (lateral teeth of petal blades often nearly or quite obsolete); Mt. Dana, *Congdon;* Mt. Warren, *Congdon;* Mt. Goddard, *Hall & Chandler* 675; Denel's Peak, upper Kern, *Hall & Babcock* 5515; Mineral King, *T. Brandegee;* Hockett Mdws., *Hall* 8471.

Refs.—Silene watsonii Rob. Proc. Am. Acad. 28: 143 (1893). *Lychnis californica* Wats. Proc. Am. Acad. 12: 248 (1877), type spms. from Ebbett's Pass (*Brewer* 2081), Mt. Dana *(Bolander),* and Sierra Co. *(Lemmon);* not *Silene californica* Dur. *Silene lacustris* Eastw. Bot. Gaz. 41: 284 (1906), type loc. Monarch Lake near Mineral King, *Eastwood*, seems to belong here.

S. watsonii, as well as the nearly related S. grayi, is variable in shape and size of the petals, but there could not be specific division of either species on this basis without violence, since our material of each represents a natural unit. It may be specially observed that the lateral lobes in both these species vary in size, and are often much reduced or obsolete.

S. suksdorfii Rob. (Bot. Gaz. 16: 44, pl. 6, figs. 9-11,—1891, type loc. Cascade Mts., Wash.) is chiefly characterized by the rounded or obsolete lateral teeth of the petals and the 10 calyx nerves anastomosing above. It is said to be allied to S. grayi and is attributed to Mt. Stanford, Nevada Co. (Syn. Fl. 1^1: 222). In view of what has been said above the points of difference between this species on the one hand and S. grayi and S. watsonii on the other seem weakened. Such material as is before us from the Nevada Co. region we have definitely referred to S. watsonii.

19. AGROSTEMMA L.

Tall hairy annual, with linear exstipulate leaves and few long-peduncled purplish-red flowers. Calyx-tube ovoid, with 10 strong ribs, the 5 teeth conspicuously prolonged into foliaceous lobes exceeding the 5 large entire unappendaged petals. Stamens 10. Capsule coriaceous, dehiscent by 5 teeth. —Species 2, Mediterranean region. (Latin ager, a field, and stemma, a wreath, the showy flowers in ancient times made into garlands.)

1. **A. githago** L. Corn Cockle. Erect, rather strictly branching, 1½ to 2 feet high, hirsute with long ascending or somewhat appressed whitish hairs, especially on the peduncles and calyx; leaves 2 to 4 inches long, 1½ to 2½ lines wide, tapering to the acute apex; flowers solitary, long-peduncled; calyx-teeth ⅝ to ⅞ inch long, rather longer than the tube, or in age much longer

and eventually deciduous from it; corolla $\frac{7}{8}$ to $1\frac{1}{2}$ inches in diameter; blade of petals obovate, black-dotted toward the claw.

Occasional grain-field waif, native of Europe, first reported from Berkeley in 1891. Since then more widely reported but not yet common.

Locs.—Live Oak, Sutter Co., *J. A. Wilkinson* in 1908; College City, Colusa Co., *Alice King* in 1906; St. Helena, *Clara Hunt* in 1908; San Bernardino (Muhl. 8: 81).

Refs.—Agrostemma githago L. Sp. Pl. 435 (1753), type European; Jepson, Fl. W. Mid. Cal. 166 (1901).

CERATOPHYLLACEAE. Hornwort Family.

Aquatic submerged fragile herbs, with cylindric jointed stems. Leaves whorled, sessile, exstipulate, 2 to 3 times cut into linear or filiform divisions. Flowers minute, axillary, monoecious, without perianth but surrounded by an 8 to 12-cleft persistent involucre. Staminate flower consisting of numerous stamens crowded on the receptacle; anthers sessile. Pistillate flower consisting of one pistil; ovary superior, 1-celled, with a single ovule. Fruit indehiscent, beaked by the slender persistent style, spinose or tuberculate at base. Embryo with highly developed plumule. No endosperm.

Bibliog.—Schleiden, M. J., Beitr. zur Kenntnis der Ceratophylleen (Linn. 11: 513-544, t. 11,—1837). Pearl, R., Variation and Differentiation in Ceratophyllum (Carn. Publ. 58, 1-136, —1907).

1. CERATOPHYLLUM L.

The only genus, consisting of 3 polymorphous species. (Greek keras, a horn, and phullon, a leaf, the leaves cut into slender rigid divisions.)

1. **C. demersum** L. Hornwort. Stems slender, $\frac{1}{2}$ to 2 feet long; leaves in whorls of 6 to 8, the segments prickly-dentate, $\frac{1}{4}$ to 1 inch long; style as long as and forming a beak to the achene; achene variable, 1 to 2 lines long, with a horn or reflexed spur on each side near the base or spurless, the margin winged or wingless, and the sides sometimes tuberculate.

Ponds and lakes; widely distributed in California. All continents. Aug. Seldom collected in fruit.

Locs.—Old Mission Dam, San Diego, *Chandler;* Ramona, *K. Brandegee;* San Bernardino, *Parish;* Mohave River at Camp Cady (near Daggett), *Parish;* Santa Cruz; Gilroy, *Jepson;* Alvarado, *Jepson;* San Francisco; Clear Lake, *Jepson;* Blue Lake, Humboldt Co., *Blasdale.*

Refs.—Ceratophyllum demersum L. Sp. Pl. 992 (1753), type European; Jepson, Fl. W. Mid. Cal. 192 (1901).

NYMPHAEACEAE. Water-lily Family.

Aquatic perennial herbs with horizontal rootstocks or with tubers. Leaves floating or erect, peltate or deeply cordate. Flowers large, solitary, complete, on long peduncles. Sepals 3 to 12. Petals 3 to many. Stamens 6 to numerous. Carpels 3 to many, superior, united into a single pistil with many cells, or distinct.—Genera 8 and species 45, widely distributed.

Bibliog.—Greene, E. L., Nymphaea and Nuphar (Bull. Torr. Club, 14: 177-179,—1887). Coville, F. V., Wokas, a primitive food of the Klamath Indians (Rep. U. S. Nat. Mus. 1902: 725-739,—1904. An interesting account of the gathering of the seeds by the Klamath Indians, accompanied by 13 plates in illustration of the plant and the harvesting process). Cook, Mel T., Development of the Embryo-sac and Embryo of Castalia odorata and Nymphaea advena (Bull. Torr. Club, 29: 211-220,—1902. As a result of his studies Cook places Nymphaeaceae in or near the order Naiadales). Miller, G. S. Jr., & Standley, P. C., The N. Am. Species of Nymphaea (Contrib. U. S. Nat. Herb. 16: 63-108,—1912).

Petals many; pistil 1, compound..1. Nymphaea.
Petals 3 or 4; pistils several, distinct....................................2. Brasenia.

1. NYMPHAEA L. Pond Lily.

Aquatic or subterrestrial plants. Scapes and leaves from creeping rootstocks. Leaves cordate; petioles long. Sepals 5 to 12, conspicuous, orbicular.

concave, mostly petal-like, unless at base or on the outside. Petals 10 to 20, small and thick, bearing more or less resemblance to staminodia. Stamens numerous, densely imbricated around the ovary, at length recurving; anthers linear; filaments very short. Ovary 10 to 25-celled, the stigmas radiating upon its truncate or disk-like summit. Fruit coriaceous-baccate.—Species about 25, all continents, but chiefly in the tropics. (Latin name of the water-lily.)

1. **N. polysepala** Greene. Indian Pond Lily. Leaves 6 to 11½ inches broad, 7 to 14½ inches long, rounded at apex, the lobes rounded and the narrow or closed sinus ⅓ to ½ the length of the blade; calyx yellow or brownish red, subglobose or somewhat cup-shaped, 3 (or when fully expanded 4 to 5) inches in diameter; sepals 9 to 12; petals 12 to 18, nearly or quite concealed beneath the many stamens; anthers dark red; stigmatic rays 15 to 24; fruit ovate or subglobose, 1 to 1½ inches in diameter, with short constricted neck and convex disk.

Ponds, central California, more especially near the coast or in the high mountains. North to Alaska and east to the Rocky Mts. The seeds are an important source of food supply to the Klamath Indians.

Locs.—Coast Ranges, near the coast: east of Santa Cruz (acc. Anderson, Nat. Hist. Santa Cruz, 35); Mountain Lake, San Francisco (Zoe, 2: 338); Olema, *Brewer* 1481; Santa Rosa, *Chesnut;* Soldiers Ridge, Yollo Bolly Mts., *Jepson;* Arcata, *Jepson* 1920; Mad River near Vances, *Chandler;* Log Lake, w. Siskiyou, *Butler* 1667; Sisson, *Jepson.* Sierra Nevada, 4500 to 7500 ft.: Eagle Peak Mdws., Yosemite, *Hall* 9192; Hetch-Hetchy to Hog Ranch, *Jepson* 3489; Lake Tahoe, *Blasdale;* Big Meadows, Plumas Co., *R. M. Austin;* Susan River, Honey Lake Valley, *Davy* 3336. Klamath Marsh, Ore., contains about 10,000 acres of solid growth *(Coville).*

Refs.—NYMPHAEA POLYSEPALA Greene, Man. Bot. Bay Reg. 8 (1894). *Nuphar polysepalum* Engelm. Trans. Acad. Sci. St. Louis, 2: 282 (1865), type loc. Osborn's Lake, Colo., *Parry;* Jepson, Fl. W. Mid. Cal. 193 (1901).

NYMPHAEA ADVENA Soland. in Ait. Hort. Kew, 2: 226 (1789), loc. class. Atlantic States. Leaf lobes acutish; sepals usually 6; anthers yellow.—Californian plants from Stockton and Clear Lake have been referred to this species by Greene (Fl. Fr. 288) and by Jepson (Fl. W. Mid. Cal. 192; Erythea, 1: 13). These are probably mere forms of N. polysepala. The implied opinion of Gerritt & Miller (Contrib. U. S. Nat. Herb. 16: 88) that we have only one species may well be provisionally accepted.

2. BRASENIA Schreb.

Leaves peltate, oval, floating, long-petioled from fleshy creeping rootstocks. Flowers small, dull purple. Sepals and petals 3 or 4. Stamens 12 to 18 with filiform filaments. Carpels 4 to 18, distinct, becoming indehiscent clavate pods.—Species 1. (Derivation unknown.)

1. **B. schreberi** Gmel. Water Shield. Leaves 1½ to 4 inches long; petals linear, about 6 lines long.

Lakes and slow streams: central California and northward. North America, Asia, Africa, Australia.

Locs.—Little Kern Lake, Kern Cañon, 6200 feet, *Jepson* 4924; Stockton, 35 feet (Fl. Fr. 288); Lakeport, *Jepson;* Pit River near Ft. Crook, *Brewer* 2188.

Refs.—BRASENIA SCHREBERI Gmel. Syst. Veg. 1: 853 (1796); Jepson, Fl. W. Mid. Cal. ed. 2, 164 (1911). *B. peltata* Pursh, Fl. 389 (1814).

RANUNCULACEAE. Buttercup Family.

Herbs with alternate or basal leaves (excepting the opposite-leaved climber Clematis). Flowers with the parts all free and distinct, commonly perfect, solitary, or in terminal racemes or panicles. Sepals usually 5, always more than 2, often petal-like. Petals usually 5, often more, sometimes minute or altogether wanting. Stamens indefinite, usually numerous. Pistils several, superior, always 1-celled, bearing a single style. Fruit a follicle or achene.

rarely a berry. Seeds containing abundant endosperm and a minute embryo.—Leaves mostly palmately divided or lobed, in all cases without stipules, but the petioles often with a broad sheathing base. Flowers regular, except in Delphinium and Aconitum, and most frequently with a pronounced convex receptacle. Species of Thalictrum and Clematis are dioecious or polygamo-dioecious. Actaea has only 1 pistil. In Paeonia, the petals and stamens are inserted on a fleshy disk.—This is a widely diffused order, represented in all continents, consisting of 30 genera and about 1080 species. All of our genera are represented in Europe except Trautvetteria and Kumlienia, and all in the Old World except the latter. The family contains many choice garden and medicinal herbs.

Bibliog.—Hiern, W. P., Forms and Distribution over the world of the Batrachium section of Ranunculus (Jour. Bot. 43-49, 65-69, 97-107,—1871). Gray, A., Notes on Myosurus (Bull. Torr. Club, 13: 1-4,—1886); Revision of N. Am. Ranunculi (Proc. Am. Acad. 21: 363-378,—1886); Delphinium, N. Am. Sp. (Bot. Gaz. 12: 49-54,—1887). Trelease, W., N. Am. Species of Thalictrum (Proc. Bost. Soc. Nat. Hist. 23: 293-304, pl. 1,—1886). Prantl, K., Morph. und Systematik der Ranunculaceen (Engler, Bot. Jahrb. 9: 225-273,—1888). Britton, N. L., Am. species of genus Anemone and the genera which have been referred to it (Ann. N. Y. Acad. Sci. 6: 215-238,—1891); Ranunculus repens and its eastern N. Am. allies (Trans. N. Y. Acad. Sci. 12: 2-6,—1892). Jones, M. E., Rev. N. Am. species Aquilegia (Zoe, 4: 254-260,—1893). Greene, E. L., Revision of Myosurus (Bull. Cal. Acad. 1: 276-279,—1885); Some Californian Ranunculi (Bull. Torr. Club, 14: 116-119,—1887); Remarks on the Genus Actaea (Pitt. 2: 107-109,—1890); On some N. Am. Ranunculi (Pitt. 2: 58-65, 109-111,—1890); Ranunculaceous Monotypes (Pitt. 3: 188-195, pls. 2-4,—1897); Segregates of Caltha leptosepala (Pitt. 4: 73-81,—1899); Certain Calif. Thalictra (Muhl. 5: 128-131,—1909). Huth, E., Monog. Gatt. Caltha (Helios. 9: 55-78, 99-103, t. 1,—1892); Rev. der kleineren Ranunculaceen-Gattungen (Engler, Bot. Jahrb. 16: 278-324,—1893); Monog. Gatt. Delphinium (l. c. 20: 322-499,—1895). Eastwood, A., Notes on Cal. Species of Delphinium (Bull. Torr. Club, 28: 667-674,—1901). Ulbrich, E., System. Gliederung und Geog. Verbreitung Anemone (Engler, Bot. Jahrb. 37: 172-334,—1906). Davidson, A., The Delphinii of S. Cal. (Muhl. 4: 33-37,—1908).

A. *Ovary several to many ovuled; fruit a follicle (a berry in Actaea).*

- Flowers regular, without spurs.
  - Petals not spurred.
    - Flowers solitary, rarely 2 or 3.
      - Petals present.
        - Flowers brownish red; petals roundish, inserted on a fleshy disk. . 1. PAEONIA.
        - Flowers white; petals linear; disk none. . . . . 2. COPTIS.
      - Petals none; sepals white (rarely pinkish or bluish).
        - Leaves simple, round-reniform . . . . 3. CALTHA.
        - Leaves compound . . . . 4. ISOPYRUM.
    - Flowers many, in racemes, white. . . . . 5. ACTAEA.
  - Petals 5, prolonged backward into hollow spurs. . . . . 6. AQUILEGIA.
- Flowers irregular, complete, with spurs; sepals 5.
  - Upper sepal spurred . . . . 7. DELPHINIUM.
  - Upper sepal helmet-like . . . . 8. ACONITUM.

B. *Ovary usually with one ovule; fruit an achene.*

- Leaves alternate or basal; flowers perfect (except in most Thalictra).
  - Petals none.
    - Cauline leaves in a single involucral whorl of 3; flowers mostly large. . . . 9. ANEMONE.
    - Cauline leaves alternate; flowers inconspicuous.
      - Leaves simple; flowers perfect. . . . . 10. TRAUTVETTERIA.
      - Leaves compound; flowers commonly dioecious. . . . . 11. THALICTRUM.
  - Petals present.
    - Sepals spurred; achenes on a slender spike-like receptacle; diminutive herbs. . . . . 12. MYOSURUS.
    - Sepals not spurred; achenes crowded on a convex receptacle so as to appear capitate.
      - Petals with a nectar-pit on claw; sepals greenish or yellowish. . 13. RANUNCULUS.
      - Petals reduced to a minute stiped nectary; sepals white, corolla-like. . . . . 14. KUMLIENIA.
- Leaves opposite; flowers polygamous; achenes with a feathery tail; woody climber. . . . . 15. CLEMATIS.

1. PAEONIA L.

Perennial herbs with ternately divided leaves. Flowers large, solitary and terminal. Calyx herbaceous, persistent. Sepals and petals 5 or 6, the latter and the numerous stamens borne on a fleshy disk adnate to the base of the calyx. Style short or none. Follicles 2 to 5, thick and leathery, several-seeded. —Species about 15, western North America, Europe, Asia. (Paion, the physician of the gods.)

1. **P. brownii** Dougl. Western Peony. Somewhat fleshy plant 8 to 14 inches high; leaves glaucous or pale, ternately or biternately divided, chiefly basal, the lobes obovate to linear-spatulate; peduncles 1 to 2 inches long; flowers $\frac{3}{4}$ to $1\frac{1}{2}$ inches broad; petals orbicular, plane, brownish red, thick and leathery, scarcely longer than the roundish concave sepals; follicles mostly 5, broadly oblong, smooth, 1 to $1\frac{1}{2}$ inches long; stems several, bending over in age and the pods resting on the ground.

Brushy hillslopes: Southern California; South Coast Ranges; Sierra Nevada from Nevada Co. north. North to Washington and east to Utah. Apr.-May.

Locs.—Palomar, *Jepson* 1561; Santa Monica Mts., *Barber;* Sisquoc River Valley, *M. S. Baker;* San Luis Mt., *Summers;* Paso Robles, *Davy;* Bell Sprs., Mendocino Co., *Davy* 5354; Greasewood Hills, w. Tehama Co., *Jepson;* Douglas City, Trinity Co., *Blasdale;* Quartz Valley, Siskiyou Co., *Butler* 1229; Ft. Bidwell, *Manning;* Hot Springs Valley, Plumas Co., *Jepson* 4102; Truckee, *Sonne.*

Refs.—Paeonia brownii Dougl.; Hook. Fl. Bor. Am. 1: 27 (1829), type loc. Mt. Hood, *Douglas;* Jepson, Fl. W. Mid. Cal. 194 (1901).

2. COPTIS Salisb. Goldthread.

Low perennial herbs with slender rootstocks. Leaves basal, divided or compound. Stems scapose, bearing 1 to 3 white flowers. Sepals 5 to 7, petal-like. Petals 5 to 7, small, linear, hooded above. Stamens 10 to 25. Pistils 10 to 12, stipitate, in fruit forming an umbel of follicles.—Species 9, northern hemisphere. (Greek koptein, to cut, referring to the divided leaves.)

1. **C. laciniata** Gray. Scapes 2 or 3-flowered, 4 to 6 inches high; leaves trifoliolate, each leaflet deeply 3 to 5-cleft or divided, or more or less completely replaced by 3 separate leaflets; leaflets ovate, serrate or incised, $\frac{3}{4}$ to 2 inches long; sepals slender, 4 to 5 lines long, the slender petals a third shorter; follicles 4 to 6 lines long, exceeding the stipes.

Woods, North Coast Ranges, near the coast, from Mendocino Co. to Del Norte Co. North to Washington.

Locs.—Prairie Camp, Comptche, upper Albion River, forming dense mats in the forest, acc. *Charlotte Hoak;* Noyo River, *Charlotte Hoak;* Van Duzen River near Buck Mt., *Tracy* 2729; South Fork Smith River, *Jepson* 2899.

Ref.—Coptis laciniata Gray, Bot. Gaz. 12: 297 (1887), type spms. from Ore. and nw. Cal.

3. CALTHA L. Marsh Marigold.

Perennial herbs, ours with round-cordate basal leaves and 1 to 2-flowered scapes. Rootstock short, vertical, bearing a fascicle of strong fibrous roots. Sepals 5 to 9, (in ours) white or bluish on back, showy. Petals none. Stamens numerous. Pistils 5 to 10 (or to 24), bearing ovules in 2 rows along the ventral suture, in fruit becoming follicles.—Species 16, all continents save Africa. (Ancient Latin name of the Marigold.)

1. **C. biflora** DC. Scapes 1 or 2, erect, 2 to 10 inches high, exceeding the leaves; leaves crenate or nearly entire, 1 to 3 inches broad, broader than long, the basal lobes overlapping, or their inner tips turned inward and upward; sepals 6 to 9, oblong, 5 to 7 lines long; stamens about 130; follicles stipitate.

Subalpine in marshy slopes or wet meadows: Sierra Nevada and far North Coast Ranges, 6100 to 10,500 feet. June-July.

Locs.—Hockett Mdw., Tulare Co., *Culbertson* 4379; Eagle Lake, Mineral King, *Hall & Babcock* 5360; Big Creek, Fresno Co., *Hall & Chandler* 596; Tallac, *C. J. Fox, Jr.;* Yosemite Park, *Jepson* 4337 (Peregoy Mdw.), 4526 (Piute Mt.); Hot Spring Valley, Lassen Peak, *Jepson* 4080; Marble Mt., w. Siskiyou, *Chandler* 1571; Trinity Summit, *Jepson* 2056.

Refs.—CALTHA BIFLORA DC. Syst. 1: 310 (1818), type from the British Columbia coast near Banks Isl., *Menzies. C. howellii* Greene, Pitt. 4: 79 (1899), mts. from Ore. to the Sierra Nevada. *C. rotundifolia* Greene, l. c. 80. *C. leptosepala* var. *rotundifolia* Huth. Helios. 9: 68 (1892), the entire leaved form.

4. ISOPYRUM L.

Low glabrous slender perennials with (in ours) a cluster of fusiform tubers or thickened fibres. Leaves twice ternately compound, the leaflets 2 to 3-lobed, petiolulate. Flowers commonly white, solitary, terminal or axillary. Sepals 5, petal-like. Petals (in ours) none. Stamens 10 to 30. Follicles 5 to 10, oblong or ovate, 2 to several-seeded.—Species about 27. North America, Europe, Asia. (Isopyron, the Greek name of a species of Fumaria.)

Stamens about 23 to 27; peduncles surpassing the leaves..................1. *I. occidentale.*
Stamens about 10; peduncles not surpassing the leaves....................2. *I. stipitatum.*

1. **I. occidentale** H. & A. Plant of delicate habit; stems from a cluster of slender fusiform roots, branching above, 4 to 10 inches high; leaflets obovate or fan shaped, 5 to 9 lines long, glaucous beneath; flowers commonly white, rarely pink, 6 to 9 lines broad; filaments slender; follicles 5 to 7, sessile, 4 to 6 lines long; seeds 8 or 9, wrinkled.

Locally rare herb of shady places in the lower mountains, 300 to 2000 feet: Coast Ranges; Sierra Nevada. Apr.

Locs.—Coast Ranges: Gabilan Peak, *Cushman* (fls. rose-red); Mt. Hamilton, *Chandler;* Weldon Cañon, Vaca Mts., *Jepson.* Sierra Nevada: Girard, Kern Co., *Heller* 7715; Kinsley, Mariposa Co., *Hoak;* Amador Co., *Hansen.*

Refs.—ISOPYRUM OCCIDENTALE H. & A. Bot. Beech. 316 (1840), type from California, *Douglas;* Jepson, Fl. W. Mid. Cal. 194 (1901). Var. *coloratum* Greene, Erythea, 1: 125 (1893), type loc. Gabilan (Fremont's) Peak, *L. W. Cushman.*

2. **I. stipitatum** Gray. Tufted plant 1 to 3 inches high, the stems from a cluster of numerous fusiform tubers; leaves glaucous, the leaflets or divisions oblong-oblanceolate or oblongish, 2 to 4 lines long; flowers whitish, 3 to 4 lines broad; filaments enlarged in the middle; follicles 6 to 11, 2½ to 3 lines long; seeds 3 or 4.

Brushy or wooded hillslopes: North Coast Ranges, from Mendocino Co. to Siskiyou, thence east to Modoc Co., 3500 to 4500 feet.

Locs.—Yreka, *Butler* 584; Hornbrook, *Howell;* Taylor Mt., Modoc Co., *M. S. Baker.*

Ref.—ISOPYRUM STIPITATUM Gray, Proc. Am. Acad. 12: 54 (1876), type loc. Yreka, *Greene.*

5. ACTAEA L. BANEBERRY.

Perennial herbs with bi- or tri-ternately compound ample leaves. Stems tall, arising from short branching rootstocks and bearing 1 or 2 leaves. Flowers small, white, in a short terminal raceme. Sepals about 4, petal-like, roundish or obovate, concave, caducous. Petals 1 to 10, small, entire, or none. Stamens many, with small anthers and slender white filaments, longer and more showy than the petals or sepals. Pistil 1; ovules 10 in 2 rows; stigma broad, sessile, obscurely 2-lobed. Fruit a berry, somewhat poisonous.—Species 13, northern hemisphere. (Latin name of the Elder, transferred by Linnaeus to these plants.)

1. **A. spicata** L. var. **arguta** Torr. Stems one to several, 1½ to 3 feet high, arising from the scaly terminal buds of the rootstock; leaves all cauline, none basal, ½ to 2 feet long, triternately divided, then trifoliolate, or the middle divisions again ternate; leaflets broadly to narrowly ovate, rather deeply incised and sharply serrate, 1 to 2½ inches long; petioles rather short; racemes terminal, 1 inch long, or with 1 or 2 small lateral racemes in the axils of the

upper leaves; tips of sepals often pinkish; petals none, or 1 to 7 (or 9) and white, oval to rhombic-spatulate, slender-clawed; stamens 11 to 35, 2 to 3 lines long; berries ellipsoid or subglobose, red or white, with polished surface, 3 to 5 lines long.

Wooded or brushy hills, mostly north slopes: Coast Ranges from Monterey Co. north to Siskiyou; Sierra Nevada; San Bernardino Mts. North to Alaska, east to the Rocky Mts.

Locs.—Coast Ranges, 100 to 7000 feet: Little Sur River, Santa Lucia Mts., *Jepson* 2582; Berkeley, *Jepson* (pistils sometimes 2 and partly united); Glenbrook, Lake Co., *Jepson;* Salmon Summit, *Jepson* 2078; Sisson, *Jepson.* Sierra Nevada, 4000 to 8200 feet: Modoc Co., *M. S. Baker;* Bear Valley, Nevada Co., *Jepson;* Mariposa Big Trees, *Jepson* 4305; Golden Trout Creek, Tulare Co., *Jepson* 4935. Southern California: Little Bear Valley, San Bernardino Mts., *Hall* 1002.

Refs.—ACTAEA SPICATA L. Sp. Pl. 504 (1753), type European. Var. ARGUTA Torr. Pac. R. Rep. 4: 63 (1857); Jepson, Fl. W. Mid. Cal. 203 (1901). *A. arguta* Nutt.; T. & G. Fl. 1: 35 (1838), type loc. woods of the Columbia River, *Nuttall.* *A. rubra* var. *arguta* Lawson, Rev. Canad. Ranunc. 84; Jepson, Fl. W. Mid. Cal. ed. 2, 167 (1911).

6. AQUILEGIA L. COLUMBINE.

Perennial herbs with ternately compound chiefly basal leaves, petiolulate leaflets and showy solitary flowers. Sepals 5, plane, colored like the petals. Petals 5, all alike and produced backward into large hollow spurs projecting below the calyx. Stamens numerous, some sterile inner ones with dilated filaments, appearing like scarious scales. Pistils 5, becoming several-seeded follicles.—Species about 50, northern hemisphere. (Derivation doubtful, said by some to be from the Latin aquila, an eagle, on account of the claw-like spurs.)

Flowers pendulous.
  Blade of petals nearly obsolete.
    Throat of petal spurs truncate, about 2 lines in diameter...........1. *A. truncata.*
    Throat of petal spurs cut backward, about 4 lines in diameter.........2. *A. tracyi.*
  Blade of petals 3 to 5 lines long..3. *A. formosa.*
Flowers erect or soon becoming so..4. *A. pubescens.*

1. **A. truncata** F. & M. Stems several, erect, branching, $1\frac{1}{2}$ to $3\frac{1}{2}$ feet high; herbage glabrous; leaves biternate, the leaflets $\frac{3}{4}$ to $1\frac{3}{4}$ inches long, broad or roundish in outline, 3-cleft or -divided, or incised, crenately toothed, mostly broadly cuneate (sometimes rounded or truncate) at base; petioles long, those of the basal leaves 1 foot long; flowers scarlet, tinged with yellow, pendulous in anthesis, the spurs, therefore, erect, 8 to 9 lines long, truncate at the orifice, the blade almost none; sepals widely spreading, 9 to 11 lines long; follicles 8 to 10 lines long, conspicuously veined, the long styles persistent.

Moist shaded places in the lower hills, or at middle altitudes in the mountains, almost throughout California. May-July.

Locs.—Southern California: Mt. San Jacinto, *Hall* 2374; Bear Valley, San Bernardino Mts., *Parish* 3692; San Antonio Mts., *Abrams* 2714. Sierra Nevada, 4500 to 10,000 feet: Rock Creek, Mt. Whitney, *Jepson* 5061; Pine Ridge, Fresno Co., *Hall & Chandler* 155; Porcupine Flat, Yosemite Park, *H. M. Evans;* Table Lake, Tuolumne Co., *Jepson* 3392; Hetch Hetchy, *Jepson;* Bear Valley, Nevada Co., *Jepson.* Coast Ranges: San Luis Obispo, *Palmer;* Mill Creek, Santa Lucia Mts., *Jepson;* Crystal Springs Lake, San Mateo Co., *C. F. Baker* 422; Mt. Diablo, *Brewer* 1156; Green Valley Falls, Solano Co., *Platt;* Round Valley, Mendocino Co., *Westerman;* Humboldt Co., *Tracy* 2739 (Buck Mt.), 3222 (Little River); Humbug Mt., Siskiyou Co., *Butler* 1576.

Var. **pauciflora** Jepson n. comb. A more compact plant; leaves mostly basal, these and the nearly naked stems forming a dense heavy tuft; stems 1 to $1\frac{1}{2}$ feet high, few-flowered. High montane in the Sierra Nevada, observed in its extreme form at Conness Creek and elsewhere in the Yosemite Park.

Refs.—AQUILEGIA TRUNCATA F. & M. Ind. Sem. Petrop. 9, Suppl. 8 (1844), type loc. Ft. Ross; Merritt, Erythea, 4: 102 (1896); Jepson, Fl. W. Mid. Cal. 195 (1901). Var. PAUCIFLORA Jepson. *A. pauciflora* Greene, Leaflets, 1: 76 (1904), type loc. Hockett Mdws., Tulare Co.; spms. from this station (*Hall* 8463) have glabrous and not "puberulent" filaments.

2. **A. tracyi** Jepson. Similar to the preceding; puberulent and viscid throughout, especially on the stems; upper leaves reduced to small bracts; flowers larger and stamens longer; sepals reflexed; petal spurs usually spreading more widely, the throat nearly twice the diameter of the throat in no. 1, and with its orifice cut backward obliquely and not horizontally; styles very long.

Rocky places along streams, North Coast Ranges from Marin to Napa and Mendocino cos. Also, apparently, in a glabrous form in the Santa Cruz Mts. Rare. June-Sept.

Locs.—San Anselmo Cañon, Marin Co., *Eastwood;* Howell Mt., *Tracy;* Red Mt., se. Mendocino, acc. *Purdy.*

Ref.—AQUILEGIA TRACYI Jepson, Fl. W. Mid. Cal. ed. 2, 165 (1911), type from Flat Creek, Howell Mt., *J. P. Tracy.*

3. **A. formosa** Fisch. Stems $1\frac{1}{2}$ to 3 feet high; flowers crimson to scarlet; sepals 8 to 10 lines long; petal blades yellow, truncate, about $\frac{1}{3}$ to $\frac{1}{2}$ the length of the crimson spurs which nearly or quite equal the spreading sepals; follicles 10 to 14 lines long.

Higher mountains, northern California from Butte Co. to Siskiyou. North to Alaska, east to Utah.

Locs.—Colby, Butte Co., *R. M. Austin;* Ross Cañon, Modoc Co., *Austin & Bruce;* Goosenest foothills, *Butler* 902; Marble Valley, *Butler* 352. Franktown, Nev., *Heller* 10,522.

Ref.—AQUILEGIA FORMOSA Fisch.; DC. Prod. 1: 50 (1824), type loc. Kamchatka.

4. **A. pubescens** Cov. Stems 9 to 18 inches high; leaves minutely soft-pubescent or quite glabrous; leaflets small (4 to 6 lines long), cleft and crenate at apex; flowers erect, cream yellow, varying occasionally to white or to shades of red, pink or purple; sepals oblong-ovate to ovate, 7 to 11 lines long, 4 to 5 lines broad; petal blades obtuse, 4 to 5 lines long, their spurs 11 to 13 lines long.

Alpine, in rocky places, 9000 to 12,000 feet: Sierra Nevada from Tulare Co. to Mariposa Co. The typical pubescent form occurs south of Kings Cañon; the specimens received by us from north of Kings Cañon are glabrous or nearly so.

Locs.—Olancha Mt., *Hall & Babcock* 5230; East Fork Kern River, *Hall* 8453; Farewell Gap, *Purpus* 1420; Alta Mdws., *Hopping* 520; near Mt. Silliman, *Jepson* 757; Mt. Goddard, *Hall & Chandler* 671; Bloody Cañon, *Jepson* 4439; Mt. Dana, *Congdon;* Kuna Crest, Yosemite Park, *Jepson.*

Ref.—AQUILEGIA PUBESCENS Cov. Contrib. U. S. Nat. Herb. 4: 56, t. 1 (1893), type loc. White Chief Mine, Mineral King, *Coville* 1513.

7. DELPHINIUM L. LARKSPUR.

Herbs, ours perennial, with palmately divided leaves. Flowers in terminal racemes. Sepals 5, irregular, the upper one produced into a spur at the base. Petals 4, in unequal pairs, with small spreading usually oblique blade on a claw of about equal length, the upper developed backward into nectary-bearing spurs, which are concealed within the spur of the calyx. Pistils (in ours) 3, seldom more, becoming many-seeded follicles.—Species about 200. North America, Europe, Asia and Africa. (Greek delphinion, larkspur, derived from delphin, the flowers of some species resembling the classical figures of the dolphin.)

The upper pair of petals are smaller than the lower, usually whitish, rarely yellowish, lavender, or bluish, very obliquely 2-lobed, the longer lobe commonly notched or emarginate; lower pair commonly the same color as the sepals, limb slightly or deeply cleft (even in the same species), the upper surface with a central tuft of hairs, or ciliate, or the whole surface more or less hairy, but in this respect variable, even in one species. The species are difficult to discriminate, and, as immaterial altho sometimes striking variations abound, there is a tendency to multiply species rather than to search rigorously for essential points of likeness. The roots are more or less differentiated and should never be neglected in making specimens. The segmentation and pubescence of the leaves, especially the lower, furnish characters useful in writing diagnoses. The seeds have distinguishing features, but may be misleading if observations are restricted to a representation of proposed species resting on single or few individuals.

All the species are probably more or less poisonous, but most occur too sparingly in California to be a menace to cattle. D. hesperium var. recurvatum is reported as poisoning cattle in the South Coast Ranges. D. trolliifolium has a bad reputation, whilst D. menziesii is the best-known of the various species ofttimes responsible for causing a heavy mortality among cattle and sheep.

Refs.—Chesnut, V. K., Principal Poisonous Plants of the U. S. (U. S. Dept. Agr. Div. Bot. Bull. 20,—1898); Preliminary Cat. of Plants Poisonous to Stock (U. S. Bur. Animal Ind. Rep. —1898). Wilcox, E. V., Larkspur Poisoning of Sheep (Mont. Agr. Exp. Bull. 15, -1897). Chesnut, V. K., and Wilcox, E. V., Stock poisoning Plants of Montana (U. S. Dept. Agr. Div. Bot. Bull. 26,—1901). Crawford, A. C., Larkspurs as Poisonous Plants (U. S. Bur. Pl. Ind. Bull. 111, pt. 1,—1907). This last-cited paper contains many references to the literature.

A. Flowers red; follicles glabrous; seeds sharply angled, narrowly margined. -Section PHOENICODELPHIS.

Leaves divided into narrowly linear or lanceolate divisions; stem leafy......1. *D. cardinale.*
Leaves parted into broad mostly obtuse divisions.
Stem few-leaved; common..2. *D. nudicaule.*
Stem leafy; rare..3. *D. purpusii.*

B. Flowers blue, white, pink or lavender.—Section DELPHINASTRUM.

Leaves not fan-shaped; stems freely or sparsely leafy, at least, with a few leaves towards the base; upper petals usually white, the lower simulating the color of the calyx.
Root a globose tuber or a cluster of fleshy roots.
Leaves mostly twice palmately divided or cleft and toothed.
Follicles erect, glabrous; foothills and middle altitudes.........4. *D. decorum.*
Follicles strongly curved-diverging, pubescent; n. Mendocino to Siskiyou and Modoc; higher altitudes.............................5. *D. menziesii.*
Leaves commonly pedately divided into very narrow, mostly entire, lobes; northern Sierra Nevada at higher altitudes.......................6. *D. pauciflorum.*
Root a cluster of hard woody, often fusiform, fibres.
Stems very tall; flowers numerous; pedicels spreading, the racemes loose or, at least, broad; follicles glabrous.
Ultimate leaf-lobes little unequal, obtuse, mucronulate; raceme mostly loose; herbage glabrous; far North Coast Ranges.........7. *D. trolliifolium.*
Ultimate leaf-segments unequal, lanceolate or acute.
Flowers slightly puberulent; herbage glabrous; Sierra Nevada............ 8. *D. scopulorum.*
Flowers rather densely pubescent; herbage pubescent; coast species........ 9. *D. californicum.*
Stems tall; racemes commonly very strict or cylindric, sometimes loose; follicles puberulent.
Petioles hirsute with spreading hairs; seeds densely covered with thin processes, as if scaly-echinate; Sierra Nevada, lower altitudes....10. *D. hansenii.*
Seeds not scaly-echinate.
Coastal or interior valley species.
Petioles hirsute with spreading hairs, mostly short; racemes of medium length and often loose; flowers commonly royal purple, rarely pinkish; mostly central Coast Ranges.....11. *D. variegatum.*
Petioles finely canescent.
Sepals densely pubescent on the back (usually blurring the color) in a median longitudinal band; pedicels mostly 2 to 6 lines long; leaf-lobes mostly short; petioles mostly short; west-central California, chiefly.............12. *D. hesperium.*
Sepals lightly pubescent on the back (not blurring the color); pedicels mostly 4 to 12 lines long; leaf-lobes usually long; petioles often long; Southern California chiefly..13. *D. parryi.*

Desert or transmontane species; leaves thickish; stems and petioles glabrous or nearly so.
  Flowers a light but lively blue; leaves glabrous; Death Valley region, and Mohave and western Colorado deserts.....14. *D. parishii.*
  Flowers deep-blue; leaves sparingly pubescent; chiefly east side of northern Sierra Nevada..................15. *D. andersonii.*
Leaves cuneately fan-shaped; stems scape-like; inner North Coast Ranges..16. *D. uliginosum.*

1. **D. cardinale** Hook. SCARLET LARKSPUR. Stem stout, 3 to 6 feet high, leafy; leaves 3 to 9 inches broad, divided into 5 to 7 narrowly linear or lanceolate divisions, the divisions usually again lobed or parted; racemes ½ to 1½ feet long; pedicels of about the same length as the flowers; flowers bright scarlet; sepals 6 to 9 lines long, exceeded by the spur; petals mostly yellow, the upper unequally 2-lobed, one lobe truncate, the other very much longer, emarginate, and hairy at tip on inside; lower pair of petals with ovate blade commonly notched at apex, short-hairy on inside.

Among shrubs or bushes, mesas, foothills or washes, 500 to 1500 feet: Southern California, from the coast to the interior (cismontane) valleys, rarely extending to the borders of the Colorado Desert. Lower California. May-June.

Locs.—Little Santa Anita Cañon, San Gabriel Mts., *Abrams* 2647; San Bernardino, *Parish;* Temescal Wash, *Jepson* 1572 (associated with Romneya coulteri); Palomar, *T. Brandegee;* San Felipe, *D. Cleveland.*

Refs.—DELPHINIUM CARDINALE Hook. Bot. Mag. t. 4887 (1855), based on cult. plants, the seed sent by *Wm. Lobb,* who collected near Los Angeles; Torr. Bot. Mex. Bound. 30, pl. 2 (1859).

2. **D. nudicaule** T. & G. RED LARKSPUR. Stems slender, 1 to 2 feet high, few-leaved or quite naked; herbage glabrous or nearly so; leaves somewhat succulent, 3 to 5-parted into broad mostly obtuse divisions, the divisions cleft, lobed or entire; racemes 2 to 12-flowered, loose and open; pedicels 1 to 3½ inches long, the lower often much longer than the upper; calyx red, glabrous or very sparsely puberulent; sepals 4 to 6 lines long, the spur nearly one-half longer; petals partly or mostly yellow, the upper narrowly obovate, sharply notched at summit, much larger than the small cleft lower ones; follicles glabrous, divergent-curving.

Banks of rivulets and rocky summits of the Coast Ranges from the Santa Lucia Mts. to Marin Co. and western Solano, and northward to Siskiyou Co. Also in the Sierra Nevada, but rare. North to southern Oregon.

Locs.—Coast Ranges: Santa Lucia Mts. (Zoe, 4: 148); Kings Mt., San Mateo Co., *C. F. Baker* 975; Mt. Day, *R. J. Smith;* Mt. Tamalpais, *Jepson;* Vaca Mts., *Jepson;* Kelseyville, *Irwin;* Ukiah, *Purdy;* Potter Valley, *Nettie Purpus;* Mt. Hull, *Hall* 9556; Kneeland Prairie, *Tracy* 2635; Humbug divide, Siskiyou Co., *Butler* 599. Marysville Buttes, *Blankinship.* Sierra Nevada: Porcupine Flat, Yosemite Park, *H. M. Evans;* Indian Valley, Plumas Co., *R. M. Austin;* Modoc Co., *M. S. Baker.*

Refs.—DELPHINIUM NUDICAULE T. & G. Fl. 1: 33 (1838), type from California, *Douglas;* Jepson, Fl. W. Mid. Cal. 197 (1901). *D. luteum* Heller, Bull. S. Cal. Acad. 2: 68 (1903), type loc. Bodega Bay, *Heller* 5256; leaves sparsely short-hairy; flowers pale yellow, pubescent.—Ex. char.

3. **D. purpusii** Brandegee. Stems 1½ to 3 feet high; stems and petioles slightly pubescent, the leaves a little ciliate; leaves 2 to 3 inches broad, 3-cleft into very broad toothed or incised lobes; racemes sparsely flowered, 4 to 8 inches long; flowers purplish red or dull pink, disposed to dry lavender; sepals about 4 lines long, much shorter than the thickish spur; follicles 7 to 10 lines long.

Rocky slopes, Greenhorn Range in the extreme southern Sierra Nevada. Apr.-May. Rare.

Locs.—Chaparral, e. slope Greenhorn Range, *Hall & Babcock* 5073; mouth of Kern Cañon, *Heller* 7655.

Refs.—DELPHINIUM PURPUSII Brandegee, Bot. Gaz. 27: 444 (1899), type loc. Erskine Creek, Kern Co., *Purpus* 5015. *D. roseum* Heller, Muhl. 2: 35 (1905), type *Heller* 7655.

4. **D. decorum** F. & M. Stem lax, 1 to 1¼ (or 2) feet high; herbage glabrous, or sometimes slightly pubescent, especially the petioles and pedicels; basal leaves thick, often somewhat succulent, roundish in outline, 1 to 2½ inches broad, mostly shallowly 3 to 5-parted into broadly cuneate or roundish segments; segments entire, or 3-cleft or -lobed, the lobes obtuse, mucronate; upper leaves pedately 3 to 5 or rarely 7-parted into linear-oblong lobes; racemes mostly many-flowered, 2 to 4 (or 11) inches long; pedicels slender, spreading, ½ to 1 or 2 inches long; flowers purple-violet, glabrous or nearly so; sepals oval, 5 to 8 lines long, equaled or excelled by the spur; mature follicles thickish, oblong, glabrous, 5 to 6 lines long, erect or the tips spreading; seeds sinuous-roughened with short scales.

Open woods: Coast Ranges and Sierra Nevada foothills to Southern California. Variable in leaf outline and lobation, as, also, in branching.

Locs.—Morgan, e. Tehama Co., *Hall & Babcock* 4362; Wimmeshaw Creek, w. Tehama Co., *Jepson;* Calistoga, *Jepson;* Howell Mt., *Tracy* 1475; Bolinas, *Chesnut & Drew;* Mt. Diablo, *Davy* 1263; Mt. Day and Arroyo Hondo, Santa Clara Co., *R. J. Smith;* Loma Prieta, *Davy* 491; San Bernardino Mts., *Parish* 5724; Mt. San Jacinto, *Jepson* 1289; Cuyamaca Mts., *T. Brandegee.*

Var. **patens** Gray. Pedicels glabrous or sparsely glandular-pubescent; deep blue, magneta, pink, or lavender-white; racemes mostly strict; flowers smaller (sepals 4 to 5 lines long); follicles diverging from below the middle.

Open places in woods: Sierra Nevada, 3000 to 8300 feet.

Locs.—Calaveras Co., *Davy* 1507; Yosemite Park, *Jepson* 4514 (Benson Lake), 3185 (Lake Merced); Hog Ranch Road, Yosemite Park, *Hall* 8905; Hazel Green, *Jepson;* Mt. Silliman, *Jepson* 727; Limekiln Creek, Tulare Co., *Jepson* 2787; Lloyd Mdws., Kern River, *Jepson* 4898.

Refs.—DELPHINIUM DECORUM F. & M. Ind. Sem. Petrop. 3: 33 (1837), type loc. Bodega Port; Eastw. Bull. Torr. Club, 28: 668 (1901); Jepson, Fl. W. Mid. Cal. 196 (1901). *D. menziesii* of authors and collectors as to S. F. Bay region plants. Var. *racemosum* Eastw. l. c. 671 (Marin to San Mateo cos.); var. *sonomensis* Eastw. l. c., Altruria, Sonoma Co. *D. patens* Benth. Pl. Hartw. 296 (1848), type loc. plains near junction of Yuba and Feather rivers, *Hartweg* 1632.—The type of this is exactly D. decorum acc. Greene, Pitt. 3: 15 (1896). Var. PATENS Gray, Bot. Gaz. 12: 54 (1887), type, the small-flowered plant of the middle Sierras. *D. gracilentum* Greene, Pitt. 3: 15 (1896), "middle elevations of the Sierra Nevada". *D. polycladon*, Eastw. Bull. Torr. Club, 28: 669 (1901), type loc. forks of Bubbs Creek, *Eastwood,* and *D. pratense* Eastw. l. c., type loc. Horse Corral Mdws., Kings Cañon trail, *Eastwood,* apparently belong here. *D. subnudum* Eastw. l. c. 670, type loc. Squaw Valley, Fresno Co., *Eastwood;* stems pubescent with fine white spreading deflexed hairs.—Ex. char. *D. greenei* Eastw. l. c. 674, type loc. southern Sierra Nevada; Heller, Muhl. 2: 34 (1905); peduncles and pedicels glandular-hairy.—This is a merely glandular form, represented by spms. from Limekiln Creek, Tulare Co., *Jepson* 2787.

5. **D. menziesii** DC. Stem arising from a cluster of connected roundish or cylindric tubers, 6 to 11 inches high, slender, often flexuous, usually branching at the base, the branches often strongly divergent; herbage quite glabrous, or sometimes pubescent; leaves twice palmately divided and cleft into linear or oblong, mostly obtusish, lobes; racemes 2½ to 6 inches long, mostly few (2 to several)-flowered; pedicels spreading, ½ to 1 inch long, the lower usually elongated, 1 to 1½ inches long; flowers blue, sparingly pubescent, with short scattered hairs; sepals 4 to 8 lines long, ¾ to as long as the slender spur; follicles hirsutulose or nearly glabrous, 7 to 9 lines long, curving and strongly divergent from very base at maturity, rarely subereet; seeds narrowly subconic, rotately cellular-margined at the truncate end, and a little at the pointed end, rarely on the sides.

Northern Mendocino Co. to Siskiyou Co., 1000 to 6500 feet. North to British Columbia and Montana. Our Californian material represents a rather definite type which is rather too much unlike, in appearance, apparently authentic material of this species from Vancouver Island. Our form, moreover, is insufficiently distinguished from the Californian phases of D. pauciflorum.

Locs.—Rowe's Sta., Mendocino Co., *Chandler* 1051; Horse Prairie, Trinity Summit, *Jepson* 2050; Dorleska, Salmon Mts., *Hall* 8596; Marble Mt., *Jepson* 2840; Yreka, *Butler* 642; Goosenest foothills, *Butler* 901; Modoc Co., *M. S. Baker.*

Ref.—DELPHINIUM MENZIESII DC. Syst. 1: 355 (1818), type loc. region of Puget Sound, *Menzies.*

6. **D. pauciflorum** Nutt. Stems low (5 to 15 inches high), slender, mostly simple, few-leaved, arising from a fascicle of oblong or fusiform tubers; leaves pedately divided into nearly distinct segments; segments linear or lanceolate (sometimes oblong), entire or some of them 1 or 2-toothed, 6 to 12 lines long; racemes few, 2 to 8 (rarely more) -flowered; pedicels spreading, 4 to 12 lines long; flowers blue to pink purplish; sepals 4 to 6 lines long, much shorter than the slender spur; follicles pubescent, short-oblong (4 to 6 lines long), more or less spreading at tip in age; seeds margined on the quadrate summit but not on the angles.

Sierra Nevada, 5000 to 9100 feet, mainly from Yosemite Park northward. North to Washington and east to Colorado. May-July.

Locs.—Snow Creek, Yosemite Park, *Hall* 9185; Squaw Valley, Placer Co., *Sonne;* Mt. Tallac, *Hall & Chandler* 4636; Donner Lake, *Heller* 6940; Webber Lake, *Kennedy;* se. Siskiyou, *Hall & Babcock* 4124. Perhaps also at head of Kern River (cf. Bot. Cal. 1: 11, sub "D. depauperatum").

Refs.—DELPHINIUM PAUCIFLORUM Nutt.; T. & G. Fl. 1: 33 (1838), Rocky Mts. and Blue Mts. of Ore., *Nuttall.* Var. *nevadense* Gray, Syn. Fl. 1^1: 50 (1895), type spms. from Cisco, *Bolander,* and Plumas Co., *R. M. Austin.* *D. decorum* var. *nevadense* Wats. Bot. Cal. 1: 11 (1876). *D. sonnei* Greene, Pitt. 3: 246 (1897), type loc. Truckee, *Sonne.*

7. **D. trolliifolium** Gray. COW POISON. Stems coarse, 4 to 6 feet high; herbage glabrous; leaves thinnish, 2½ to 5 lines broad, orbicular in outline, 5 to 7-cleft into cuneate segments, the segments incised or with rounded teeth, the upper leaves with acute teeth or segments; racemes very loose below, sometimes dense above, ¾ to 1 or 2 feet long; pedicels widely spreading, 1 to 1¾ inches long, or the lowermost 3 to 5 inches long, hairy or glabrous; bractlets narrowly lanceolate, 2 to 4 lines long; flowers deep blue; sepals 4 to 5 lines long, the very slender spur nearly half again as long; follicles glabrous, 9 to 12 lines long, only slightly spreading, or sometimes strongly recurved-spreading.

Moist ground on edges of woods near the coast: Humboldt Co. North to Oregon.

Locs.—Acorn, *Jepson* 1938; Campbell's, *Chesnut & Drew;* abundant in the Mad River valley (acc. Blasdale, Erythea, 4: 187); near Buck Mt., *Tracy* 2712, 2774 (2713, flowers pink). Should be looked for in nw. Mendocino Co. also.

Ref.—DELPHINIUM TROLLIIFOLIUM Gray, Proc. Am. Acad. 8: 375 (1872), type from Oregon, *E. Hall.*

8. **D. scopulorum** Gray var. **glaucum** Gray. Stems tall (2½ to 6 feet high), very leafy; herbage glabrous, sometimes glaucous; leaves 4 to 6 inches broad, deeply 5 to 7-parted into cuneate divisions; divisions incised and cleft, the central lanceolate segments of each division prominent and salient; racemes 1 to 1½ feet long; pedicels 5 to 7 (or 12) lines long, ascending; bractlets filiform, 4 to 6 lines long; flowers blue or purplish, puberulent, numerous in racemes 1 to 1½ feet long; sepals 5 to 6 lines long, the spur about as long; lower petals cleft to the middle; follicles 5 to 6 lines long, glabrous.

Higher Sierra Nevada from Yosemite Park to Nevada Co., about 6000 feet. San Bernardino Mts. North to Washington and Alaska.

Locs.—Mariposa Big Trees, *Brewer* 1940; Placer Co., *Carpenter;* Truckee, *Sonne;* Lincoln Valley, *Kennedy & Doten.* San Bernardino Mts., acc. *Huth* (Engler, Bot. Jahrb. 20: 457) and *Parish.*

Var. **luporum** Jepson n. comb. Leaves smaller (1¼ to 2¼ inches broad), very light green, the segments of the divisions more nearly equal; flowers comparatively few (5 to 13), in a rather loose raceme; calyx lightly villous-pubescent. High southern Sierra Nevada (Inyo, Fresno and Tulare cos.), 10,000 feet.

Locs.—Wildflower Lake, below Kearsarge Pass, *Jepson* 889; Trail Peak, *Jepson* 933.

Refs. DELPHINIUM SCOPULORUM Gray, Pl. Wright. 2: 9 (1853), type loc. Mimbres, N. Mex., *Wright* 842. Var. GLAUCUM Gray, Bot. Gaz. 12: 52 (1887). *D. glaucum* Wats. Bot. Cal. 2: 427 (1880), substituted for *D. scopulorum* Brew. & Wats. Bot. Cal. 1: 11 (1876), which rests on specimens from the Big Tree road, *Brewer*, and Sierra Valley, *Lemmon*. Var. LUPORUM Jepson. *D. luporum* Greene, Leaflets, 1: 76 (1904), type loc. Coyote Creek, Tulare Co., *Culbertson*.

9. **D. californicum** T. & G. COAST LARKSPUR. Stems stout, 2½ to 7 feet high, sparsely pubescent, many-leaved; leaves very large, 4 to 6 inches broad, 2 to 4 inches long, deeply parted into 3 to 5 deeply incised segments; sinuses of the primary divisions mostly closed in the lower leaves, open in the upper; racemes very dense, ¾ to 1½ feet long; pedicels 4 to 7 lines long, or the lowest somewhat more; bractlets very long and slender (4 to 8 lines long); flowers rather densely pilose-pubescent, white or whitish, or somewhat purplish inside, never fully expanded; sepals 3 to 4 lines long, commonly shorter than the spur; follicles oblong, turgid, 4 to 5 lines long, hardly, if at all, diverging; seeds black, wrinkled.

Low hills near the coast: San Luis Obispo Co. north to Pt. Reyes.

Locs.—Arroyo Grande, *Alice King;* Monterey, *F. P. McLean, Heller* 6822; Los Gatos, *Heller* 7457 (stems partly glabrous and glaucous); hills back of Stanford, *C. F. Baker* 842; Mission Hills, San Francisco, *Michener & Bioletti;* Berkeley Hills, *Greene*, Apr. 2, 1883, but probably now extinct; Albion Farm, Drake's Bay, *Jepson* 555. Also summits of the inner South Coast Range: Mt. Diablo, acc. *Greene* (Erythea, 1: 173); Cedar Mt., *Jepson* 6217.

Refs.—DELPHINIUM CALIFORNICUM T. & G. Fl. 1: 31 (1838), type from California, *Douglas;* Jepson, Fl. W. Mid. Cal. 195 (1901).

10. **D. hansenii** Greene. Stems slender or sometimes very coarse, commonly simple, 1¼ to 4 feet high; leaves twice or thrice palmately divided into narrow or oblong lobes; petioles hispid-hirsute; flowers pale blue to pink, lavender or white, essentially as in D. hesperium but usually smaller; raceme narrow, mostly dense, 1½ to 8 inches long; pedicels 2 to 4 lines long, or the lower sometimes 1 to 1½ inches long; seeds densely covered with minute scale-like processes.

Sierra Nevada foothills, 500 to 3500 feet. "The best type of it is Davy's 1326, Calaveras Co."—E. L. G., verbal statement, 1896. It has the aspect of D. hesperium and shows similar variations.

Locs.—Springville, Tulare Co., *Purpus* 5049; Milton, *Davy* 1321; Copperopolis, *Davy* 1369; Jackson, *Hansen* 104; Butte Co., *Austin & Bruce.* Var. ARCUATUM Greene; racemes more elongated (½ to 1¼ feet long), looser; spur strongly curved or straight.—Mountain Ranch, Calaveras Co., *Davy* 1608; Yosemite Valley, *Jepson;* Dunlap, Fresno Co., *Jepson* 2758; Greenhorn Range, *Hall & Babcock* 5065.

Refs.—DELPHINIUM HANSENII Greene, Pitt. 3: 94 (1896). *D. hesperium* var. *hansenii* Greene, Fl. Fr. 304 (1892), type loc. Amador Co., *Geo. Hansen.* Var. ARCUATUM Greene, Pitt. l. c., associated with D. hansenii. Var. *kernense* Davidson, Muhl. 4: 37 (1908), type loc. Mt. Cummings, Tehachapi Mts., *Hasse & Davidson* 1703.

11. **D. variegatum** T. & G. ROYAL LARKSPUR. Stems erect, simple or branching above, ¾ to 1½ feet high; herbage hispidulous with spreading hairs, especially at base; leaves regularly twice or thrice parted or divided, the segments oblong, mostly obtusish (or those of the upper leaves acute), mucronulate, usually diverging; raceme few (about 1 to 10)-flowered, loose, the pedicels ½ to 1½ inches long, or the lower ones sometimes much elongated; flowers royal purple, rarely whitish lavender; sepals 7 to 12 lines long; spur stoutish, as long as the sepals, the tip often slightly curved; lower petals large, elliptic or roundish, commonly colored like the sepals; upper petals obliquely oblong,

whitish; follicles oblong, rather turgid, 7 to 10 lines long, hispid-pubescent; angles of the seeds narrowly winged, the wings soft-cellular, commonly sordid.

Open grassy hills, South Coast Ranges from Mendocino Co. to San Mateo Co. and San Luis Obispo Co. Commonly occurring gregariously or in small colonies.

Locs.—Potter Valley, *Netta Purpus*; Scotts Valley, Lake Co., *Tracy*; Crystal Springs Lake, San Mateo Co., *Davy* 1067; Redwood, *Jepson* 5734; San Martin, *Chandler* 920; Paso Robles, *Barber*; Santa Margarita Valley, *Summers*. Passes into D. parryi var. maritimum Davidson, in the neighborhood of the last-named station.

It also passes into the scarcely distinguishable var. APICULATUM Greene; flowers usually on shorter pedicels in a cylindrical raceme.—Inner foothills from Butte, Tehama and Napa cos. southerly to Santa Clara Co.: Clear Creek, Butte Co., *Heller* 5520; Tehama Co., *Jepson*; Calistoga, *Jepson*; Oakville, *R. Kuhn*; Yountville, *Jepson*; Vacaville, *Jepson*; Montezuma Hills, *Jepson*; Antioch, *Davy* 971; near Mt. Hamilton, *Pendleton*.

Refs.—DELPHINIUM VARIEGATUM T. & G. Fl. 1: 32 (1838), type from California, *Douglas*; Jepson, Fl. W. Mid. Cal. 196 (1901). *D. emiliae* Greene, Erythea, 2: 120 (1894), type loc. Booth ranch, Knights Valley, *Greene*. Var. APICULATUM Greene, Fl. Fr. 304 (1892). *D. apiculatum* Greene, Pitt. 1: 285 (1889), type loc. plains near Byron Springs.

12. **D. hesperium** Gray. WESTERN LARKSPUR. Stem commonly simple, 1½ to 3 feet high, arising from a cluster of thick-fibrous roots or a single woody taproot; herbage shortly pubescent; leaves 2 to 3 times palmately cleft into oblong or linear spreading segments; raceme rather dense, virgate, 6 to 14 inches long; pedicels 2 to 6 lines long, or the lowest 1 inch, strictly erect; flowers commonly blue, rarely pink or white or intermediate shades; sepals 4 to 6 lines long, equaled or exceeded by the straight spur, somewhat densely puberulent on the outside or the alternate ones with a rather definite puberulent band; petals little shorter than the sepals; follicles short-oblong, 3 to 5 (or 7) lines long, pubescent; seeds with a loose cellular whitish coat, which is produced into narrow wings on the angles.

Dry open ground in the foothills: Coast Ranges (Humboldt Co. south to Contra Costa Co. and Monterey Co.). Flowering at beginning of the dry season; rather common, but occurring as scattered individuals, rarely in colonies. No one constant and definite distinction between this species and D. parryi has yet been advanced. The two species, in certain broad aspects, are unlike and may be retained in spite of occasional specimens (such as plants from Buck Mt., Humboldt Co.), which blur the most carefully sought differences.

Locs.—Humboldt Co., *Chandler* (Klamath River), *Tracy* 3041 (Kneeland Prairie), 2755 (Buck Mt.); Sherwood Valley, Mendocino Co., *Jepson* 1835; Vaca Mts., *Jepson*; Howell Mt., *Jepson*; South Los Guilicos, Sonoma Co., *Bioletti*; Glen Ellen, *M. S. Baker*; Mt. Tamalpais, *Bioletti*; Berkeley, *Jepson*; Mt. Diablo, *Jepson*; Pilarcitos Lake, San Mateo Co., *Davy* 1152; Los Gatos, *Heller* 7440; Coyote Creek, Santa Clara Co., *Jepson*; Paso Robles, *Barber*; Thomas Valley, San Jacinto Mts., *Hall*.

Var. **recurvatum** Jepson n. comb. Habit of the species; leaves usually with narrower more acute divisions; flowers pink-lavender or lavender-white, rarely blue; sepals recurving.—Low, especially alkaline, lands, Sacramento and San Joaquin valleys, and saline valleys of the inner South Coast Ranges. This variety passes into the species and lacks distinguishing marks for specific or even good varietal status. The term linear-oblong cannot be properly applied to the sepals as exhibited in the usual collections. The sepals (2 or mostly 3 lines broad) are no narrower than often in the species, the spur is often blunt, but it is often so in the species, and as to color character both the species and this variety show a full line of the variant colors prevailing in the Californian species of the section Delphiniastrum.

Locs.—Willows, *Jepson*; Pit River ferry, *H. E. Brown*; Little Oak and Montezuma Hills, Solano Co., *Jepson*; Antioch, *Chesnut & Drew*; Porterville, *Donnelly*; Estrella, *Jared*; Carrizo plain, *Eastwood*; upper San Joaquin valley, Kern Co., *Davy* 1881.

Var. **cuyamacae** Jepson n. comb. Leaves thickish or subcoriaceous, the sinuses with straight rather than curving sides, the lobes broad and mainly cleft at apex; raceme dense (like San Joaquin Co. specimens of var. recurvatum) or loose; flowers blue, like those of the species.—Cuyamaca Mts. Perhaps also on Mt. Pinos.

Var. **seditiosum** Jepson n. var. Leaves mostly at base, minutely pubescent or canescent, the segments filiform or narrowly linear, more or less revolute.—(Folia plerumque basalia, puberulentia vel canescentia, segmentis filiformis vel linearis angustis plus minusve revolutis.)—Monterey Co. towards the coast. This variety, with leaves simulating those in forms of D. parryi, may be said to represent a passing over into that species. It is inclined to lose its leaf-blades in a similar manner.

Locs.—Upper San Antonio Creek, Santa Lucia Mts., *Jepson* 1655 (type); Pacific Grove, *Tulestrom*.

Refs.—DELPHINIUM HESPERIUM Gray, Bot. Gaz. 12: 53 (1887), Mariposa Co. and Monterey northward to w. Ore.; Jepson, Fl. W. Mid. Cal. 196 (1901). *D. simplex* Brew. & Wats. Bot. Cal. 1: 10 (1876), not of Dougl. (1829). Var. RECURVATUM Jepson. *D. recurvatum* Greene, Pitt. 1: 285 (1889), moist subsaline grounds along the San Joaquin River from Antioch to Tulare; collection was made by Greene at Byron, Mar. 24, 1889, and may well be taken as the type; Heller, Muhl. 2: 34 (1905). Var. CUYAMACAE Jepson. *D. cuyamacae* Abrams, Bull. Torr. Club, 32: 538 (1905), type loc. Cuyamaca Lake, *Abrams* 3888; the leaves are similar to those of D. andersonii.

13. **D. parryi** Gray. Stems commonly simple, 1 to $2\frac{3}{4}$ feet high, arising from a short caudex crowning several woody-fibrous roots; herbage minutely puberulent; leaves twice divided and redivided into narrowly linear lobes, the lobes usually elongated, acute, $\frac{1}{2}$ to $2\frac{1}{2}$ inches long, and often arcuate-contorted; upper leaves often pedately 5-divided into filiform lobes; racemes virgate, often cylindric, sometimes loose, strict, 4 to 14 inches long; pedicels mostly 4 to 12 lines long or the lower longer; flowers blue or light purplish, rarely white-flowered; sepals 6 to 8 lines long, equaling the spur, $1\frac{1}{2}$ to 2 times as long as the petals; follicles puberulent, 5 to 6 lines long; seeds with a loosely cellular whitish margin to the angles.

Sandy or loam soil, open ground, Southern California, occurring mainly from the coast to the interior (cismontane) valleys, but reaching the edge of the Colorado Desert in eastern San Diego Co.; north to the San Carlos Range and southern Sierra Nevada (Tulare Co.). May-June. With the coming on of the rainless season, the blades of the lower leaves are inclined to disjoint roughly in age, leaving the rigid petioles behind.

Locs.—San Timoteo Cañon, *Jepson*; La Presa, *Hall* 3896; Carrizo Creek, *T. Brandegee*; Coahuilla Valley, *Jepson* 1473; Menifee, *Alice King;* Winchester, *Hall* 424; Vanderventer's, *Jepson* 1429; San Jacinto River Cañon, *Hall* 2013; Riverside, *Jepson* 1221; San Bernardino, *Parish* 7091; Claremont, *Chandler;* Kaweah, *Eastwood;* Waltham Creek, near Alcalde, *Jepson* 2654; San Carlos Creek, San Carlos Range, *Jepson* 2736.

Var. **blochmanae** Jepson n. comb. Leaf-lobes narrowly linear ($\frac{1}{2}$ to $\frac{3}{4}$ line wide); flowers large, in a dense short raceme ($2\frac{1}{2}$ to 4 inches long), the light blue sepals in pleasing contrast to the white petals; sepals 8 to 11 lines long, with crisped edges; seed unknown.—Near the coast, San Luis Obispo Co. Known only at Nipoma, where first collected by W. H. Brewer, Apr. 10, 1861, and by Ida M. Blochman, thirty-two years later, the specimens of the latter exhibiting exactly the distinctive features of the earlier collection.

Var. **maritimum** Davidson. Commonly branching; leaf-lobes mostly 1 to 3 lines broad, often falcately curving; raceme loose, commonly elongated (4 to 15 inches long), the pedicels 1 to 2 inches long; flowers large, the sepals 6 to 11 lines long; angles of the seed not winged.—Coast region, San Luis Obispo south to Los Angeles Co. and San Diego. Remarkable for its wingless seeds.

Locs.—Santa Margarita Valley, *Summers;* Oso Flacco, San Luis Obispo, *Summers;* Santa Monica Cañon, *Barber* 133; San Diego, *T. Brandegee*.

Refs.—DELPHINIUM PARRYI Gray, Bot. Gaz. 12: 53 (1887), type loc. San Bernardino, *Parry, Lemmon, Parish;* Syn. Fl. 1^1: 48 (1895). Var. BLOCHMANAE Jepson. *D. blochmanae* Greene, Erythea, 1: 247 (1893). *D. ornatum* Greene, Fl. Fr. 304 (1892), type loc. Nipoma, San Luis Obispo Co., *Brewer* 409. Var. MARITIMUM Davidson, Muhl. 4: 35 (1908), type loc. Ballona, *Abrams* 1186.

14. **D. parishii** Gray. Stems stout or somewhat slender, 1½ to 2 feet high, one or several from the crown of a stout root, which forks into several deep-seated branches; herbage wholly glabrous or commonly so; leaves ¾ to 1½ (or 2) inches broad, the basal cut into broadish segments which are again cleft or toothed, the basal similar but often more narrowly divided; raceme virgate, many-flowered, 5 to 7 inches long; pedicels 4 to 8 lines long; flowers a light but lively sky-blue; sepals 3 to 5 lines long, the petals ⅔ as long; follicles obscurely puberulent, sometimes a little distended at the middle, 5 to 6 lines long; seeds as in D. hesperium.

Sandy washes or mesas, 500 to 7500 feet: throughout the Mohave Desert, north into Inyo Co. and south to Palm Springs in the Colorado Desert. May-June. The primary segments of the lower leaves have a disposition to be divergent, rather straight-margined and of equal breadth from base to apex, and cleft only at apex. The flowers have a characteristic and constant shade of blue, which is different from that of any other of our species. This is the only species known in the Mohave Desert.

Locs.—Red Hill, near Bishop, *Heller* 8247; Pleasant Cañon, Panamint Mts., *Hall & Chandler* 6968; Lee Well, Nelson Range, *Hall & Chandler* 7136; Providence Mts., *T. Brandegee;* Fremonts Peak, *Hall & Chandler* 6860; Calico Wash, *Jepson* 5416; Barstow, *Jepson* 5362; Ord Mt., *Jepson* 5870, 5930; Victorville, *Hall* 6201; Antelope Valley, *Davy* 2305, 2485; Palm Springs, *Parish* 6074.

Var. **inopinum** Jepson n. var. Stems 3 feet tall, the stems and leaves quite glabrous; sepals very narrow (suboblong), glabrous; follicles glabrous.—(Caules ped. 3 alti, caules foliaque glabra; sepala perangusta (suboblonga), glabra; folliculi glabri.)—Kern River Cañon, 7800 ft. alt., *Jepson* 5012. Remarkable for its high-montane habitat, its very narrow sepals and quite glabrous pale lavender calyx.

Refs.—DELPHINIUM PARISHII Gray, Bot. Gaz. 12: 53 (1887), type loc. West Cañon, Palm Springs, *Parish. D. colestinum* Rydb. Bull. Torr. Club, 39: 320 (1912), type loc. s. Utah, *Palmer* 11; not *D. colestinum* Franch (1894). *D. mohavense* Parish ined., as to the plant of Barstow (above cited); including also generally the plants of the Mohave Desert.

15. **D. andersonii** Gray. Stems several from the base, 1½ to 2 feet high; herbage more or less glaucous, glabrous or nearly so, the blades lightly pilose; leaves thickish, 1 to 2½ inches broad, deeply and incisely 2 to 3 times parted into oblong or linear segments, the teeth of the lower leaves mostly obtuse, sometimes acute; raceme rather loose, 7 to 10 inches long; pedicels ½ to 1 (or 1½) inches long; flowers blue; sepals 5 to 6 lines long, mostly longer than the stout spur, which is shortly curved at the blunt tip; follicles glabrous, 5 to 7 lines long.

Adobe soil: western Nevada, and in California on the desert side of the northern Sierra Nevada. It is uncertain whether this little-known species crosses the Sierra axis westward. Plants from the high Sierras could at present be referred here only with a mark of doubt and are not cited.

Locs.—(?) Shumway, Lassen Co., *Bruce.* Kings Cañon, Ormsby Co., Nev., *C. F. Baker.*

Refs.—DELPHINIUM ANDERSONII Gray, Bot. Gaz. 12: 53 (1887), resting on *D. menziesii* Wats. Bot. King, 11 (1871), as to plants of western Nev.

16. **D. uliginosum** Curran. Stems erect, nearly naked, 1 to 2 feet high, glabrous or sparingly hispidulose; leaves glabrous, cuneately fan-shaped, 1 to 3 inches long (on petioles as long or longer), the earliest merely cleft or toothed

at apex, the later incisely parted; racemes strict, the pedicels subequal; flowers blue or occasionally pink; sepals 3 to 6 lines long, the spur as long or longer; petals deeply notched, ciliate, and with a tuft of hairs on the upper side; follicles slender, puberulent, 4 to 6 lines long; seeds densely covered with minute blunt processes, some short, some longer and branched.

Wet places, Napa Co. north through Lake Co. to western Colusa Co.

Locs.—Howell Mt., *Tracy* 354; Butt's Cañon, Napa Co., *K. Brandegee*.

Ref.—Delphinium uliginosum Curran, Bull. Cal. Acad. 1: 151 (1885), type loc. very wet swamps, Epperson's (foothills of western Colusa Co., near Lake Co. boundary), *Mary K. Curran*.

8. **ACONITUM** L. Aconite.

Tall perennial herbs with palmately lobed leaves. Flowers showy, irregular. Sepals 5, the upper one larger and hooded or helmet-like. Upper petals 2, reduced to slender claws terminating in a nectary and covered by the helmet-like sepal, the 3 lower ones minute rudiments or wanting. Stamens numerous. Pistils 3 to 5, many-ovuled, becoming follicles in fruit.—Species about 60, northern hemisphere. (Ancient Greek name.)

1. **A. columbianum** Nutt. Western Monkshood. Stems 1½ to 3 feet high, arising from thick roots; leaves roundish in outline, 2 to 3 inches broad, parted or divided into 5 cuneate toothed or incised lobes; raceme loose, sometimes paniculate, viscid-pubescent; flowers blue, rarely white; hooded sepal 6 to 7 lines long.

Wet meadows and streamlet borders, 4000 to 8000 feet: Sierra Nevada, north to Modoc Co. and west to Trinity Co. Arizona to British Columbia. July.

Locs.—Garfield Forest, Sequoia Park, *Jepson* 4663; Soda Creek, Tulare Co., *Purpus* 5275; Middle Fork Kings River, *Henrietta M. Eliot;* Pine Ridge, Fresno Co., *Hall & Chandler;* Eagle Peak, Yosemite, *Chesnut & Drew;* Donner Lake, *Heller* 6917; Plumas Co., *Platt;* Morgan, Tehama Co., *Hall & Babcock* 4413; Ft. Bidwell, *Manning;* Mt. Shasta, *Geo. B. Grant;* Shackelford Creek, w. Siskiyou, *Butler* 1774; Salmon Mts., *Hall* 8635 (flowers white).

Ref.—Aconitum columbianum Nutt.; T. & G. Fl. 1: 34 (1838), type loc. Columbia River below Walla Walla, *Nuttall*. *A. fischeri* Brew. & Wats. Bot. Cal. 1: 12 (1876), not Reichenb.

9. **ANEMONE** L. Wind-flower.

Perennial herbs, the stems and basal leaves from a rootstock. Stem leaves none except an involucral whorl of 3 near to or distant from the solitary or umbellate flowers. Sepals 5 to 8, petal-like, imbricate. Petals none. Stamens numerous. Achenes numerous, the style short or developing into a long plumose tail. Seed suspended.—Species about 90, all continents. (Greek anemos, wind, the flowers disturbed by the wind.)

Leaves 2 to 3 times finely dissected into small segments; stems from the crown of a thick root.
  Styles densely hairy, becoming plumose tails in fruit..................1. *A. occidentalis.*
  Styles not hairy.
    Sepals elliptic or oval, 7 to 10 lines long; stems from the crown of a taproot........ 2. *A. baldensis.*
    Sepals oblong, 4 lines long; stems from a tuber....................3. *A. tuberosa.*
Leaves 3-foliolate, not dissected; stems from horizontal rootstocks.
  Involucral leaves sessile; rootstocks filiform ....4. *A. deltoidea.*
  Involucral leaves petioled; rootstocks thickened ....5. *A. quinquefolia.*

A. Styles densely soft-hairy; achenes with long plumose tails.—Subgenus Pulsatilla.

1. **A. occidentalis** Wats. Stems from the crown of a thick vertical root, 4 to 15 inches high, 1-flowered; stems, petioles and midribs woolly-pubescent, mostly glabrate, except at base of bracts and of stems; leaves divided into 5 petioled divisions, the divisions 2 or 3 times divided and cleft; involucral leaves sessile by a broad base, similar to the basal leaves; sepals 5 (or 6), white "or

purplish'', oval or broadly oblong, 1 inch long; achenes pubescent, their tails ¾ to 1 inch long, at length recurved, forming a globose head 1½ to 2 inches in diameter; receptacle minutely velvety.

Alpine, 6000 to 10,000 feet: Sierra Nevada north to Mt. Shasta, thence west to western Siskiyou. North to British Columbia. June.

Locs.—Little Kern River, *Purpus* 1813; Alta Mdws., Sequoia Park, *Hopping;* Nevada Co., *Carpenter;* Lassen Peak, *Lemmon;* Mt. Shasta, *Brewer* 1419; near Marble Mt., *Jepson* 2852.

Ref.—ANEMONE OCCIDENTALIS Wats. Proc. Am. Acad. 11: 121 (1876), mts. from British Columbia to Mt. Shasta and Lassen Peak.

B. Styles glabrous or nearly so; achenes with glabrous or pubescent tails.—Subgenus EUANEMONE.

2. **A. baldensis** L. Stems 1 to several, 4 to 15 inches high, arising from the branching crown of a thick taproot, 1-flowered; herbage glabrate (sometimes silky when young); leaves 3 times dissected into linear or oblong acute lobes, the lobes 2 to 6 lines long; flowers white or "bluish", 1 to 1¾ inches broad; sepals 5 or 6 to 8, elliptic or oval; ovary hairy; style almost capillary, glabrous or nearly so.

Hillslopes at 5000 to 7000 feet: northern Sierra Nevada; far North Coast Ranges. June-July.

Locs.—Castle Peak, *Heller* 7099; Plumas Co.; Marble Mt., *Chandler* 1676; Salmon Mts., *Hall* 6567.

Refs.—ANEMONE BALDENSIS L. Mant. Pl. 1: 78 (1767), type European; Ulbrich in Engler, Bot. Jahrb. 37: 244, fig. 4C (1906). *A. drummondii* Wats. Bot. Cal. 2: 424 (1880), based chiefly on Cal. spms. from northern Sierra Nevada and Scott Mts. *A. californica* Eastw. Proc. Cal. Acad. ser. 2, 6: 423 (1896), type loc. near Lot's Lake, w. Plumas Co., *J. R. Scupham.*

3. **A. tuberosa** Rydb. Stems 4 to 10 inches high, from a tuberous root, 1 or rarely 2-flowered; leaves 3-foliolate, glabrate, the divisions ternately cleft and toothed; flowers white or purplish, 7 to 9 lines broad; sepals 8 to 10, linear-oblong; style filiform, straight, nearly as long as the ovary; achenes densely woolly.

Panamint Mts., acc. *Coville;* Arizona to Utah.

Refs.—ANEMONE TUBEROSA Rydb. Bull. Torr. Club, 29: 151 (1902). *A. sphenophylla* Cov. Contrib. U. S. Nat. Herb. 4: 56 (1893), not Poepp.

4. **A. deltoidea** Hook. Stems 3 to 12 inches high; rootstock filiform or whip-like, several inches long; basal leaves and involucral leaves 3-foliolate; leaflets broadly ovate or rhombic, crenately toothed above the entire base, some sparingly incised, 1 to 3 inches long; sepals commonly 5, white, 6 to 11 lines long; achenes hirsute-pubescent, with straight style.

Woods, Humboldt Co. to Siskiyou Co., 600 to 5500 feet. Northward to Washington. May-July.

Locs.—Hydesville, *Tracy* 2444; Camp Grant, *Davy* 5499; Pepperwood, *Jepson* 1913; Trinity Summit, *Jepson* 2029 (common and forming beautiful spots on the forest carpet); Salmon Mts., *Hall* 8675; near Marble Mt., *Jepson* 2848. Colestin, Siskiyou Mts., Ore., *W. P. Gibbons.*

Ref.—ANEMONE DELTOIDEA Hook. Fl. Bor. Am. 1: 6, t. 3, f. A (1829), type loc. woods, Columbia River mouth, *Douglas.*

A. OREGANA Gray, Proc. Am. Acad. 22: 308 (1887), type loc. Hood River, Ore. Involucral leaves 3-divided; flowers blue.—Oregon (Waldo, near the California line, *Howell)* and Washington.

5. **A. quinquefolia** L. var. **grayi** Jepson. WOOD ANEMONE. Stems slender, 1-flowered, 4 to 12 in. high, from a thickish rootstock; basal leaf simple, of reniform outline, trifid; involucral leaves 3-foliolate, petioled, the leaflets obovate, entire at base, crenately toothed or incised above, the lateral usually oblique,

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JEPSON, Flora of California, vol. 1, pt. 5, pp. 497-528, Feb. 11, 1915.

½ to 1½ inches long; flowers white or pale blue, 6 to 8 lines broad; sepals 5 (or 6); achenes puberulent, with short recurved style.

Shady woods in mountains, mostly near the coast, 200 to 5000 feet: Santa Cruz Co. to Siskiyou Co. North to British Columbia, thence east to the Atlantic. Mar.-June.

Locs.—Santa Cruz Mts., *M. S. Baker;* Kings Mt., San Mateo Co., *C. F. Baker* 323; Mill Valley, *Jepson;* Ft. Ross, *Davy* 1674; Sonoma Creek Cañon, *M. S. Baker;* Humboldt Bay, *Tracy* 2949; Trinity Summit, *Davy* 5744; Marble Mt., *Chandler* 1551.

Refs.—ANEMONE QUINQUEFOLIA L. Sp. Pl. 1:541 (1753), type loc. Virgina. Var. GRAYI Jepson, Fl. W. Mid. Cal. 198 (1901). *A. nemorosa* Brew. & Wats. Bot. Cal. 1:4 (1876), not L. *A. nemorosa* var. *grayi* Greene, Fl. Fr. 295 (1892). *A. grayi* Behr. & Kell. Bull. Cal. Acad. 1:5 (1884), type loc. Lagunitas, Mt. Tamalpais.

10. TRAUTVETTERIA F. & M.

Perennial herbs. Leaves alternate, simple, palmately cleft, mostly basal. Stems branching at summit and bearing loose corymbose cymes of white flowers. Sepals 3 to 5, broad, white, petal-like, caducous. Petals none. Stamens numerous, filaments clavate, white, conspicuous. Achene utricular, capitate on the short receptacle.—Species 2, North America and Asia. (E. R. Trautvetter, Russian botanist, 19th century.)

1. **T. grandis** Nutt. Stems 1½ to 3 feet high; leaves deeply about 5-cleft, 2½ to 8 inches broad, unequally serrate, the basal long-, the cauline short-petioled; flowers 6 to 8 lines broad; sepals oval or roundish, concave, 2 lines long; achenes glabrous.

Mountain woods, northern California from Plumas Co. to Siskiyou Co. North to British Columbia.

Locs.—Mill Creek, Plumas Co. (acc. Bot. Cal. 2:425); Marble Mt., *Chandler* 1601.

Ref.—TRAUTVETTERIA GRANDIS Nutt.; T. & G. Fl. 1:37 (1838), type loc. shady woods, Columbia River, *Nuttall.*

11. THALICTRUM L. MEADOW RUE.

Perennial herbs with mostly tall erect stems from a short rootstock. Leaves bi- or tri-ternately compound, with petiolulate (or some sessile) leaflets. Flowers many, small (1½ to 3 lines long), panicled, rarely in a raceme, dioecious, or sometimes perfect. Sepals 4 (or 5 to 7), greenish, or more or less petal-like. Petals none. Stamens numerous with long mucronate anthers on capillary filaments. Achenes 4 to 15, veined or furrowed, sometimes inflated, tipped with the persistent long styles.—Species about 80, all continents except Australia, but chiefly north temperate North America, Europe and Asia. (Greek thallo, to grow green, the application uncertain.)

- Flowers in a simple raceme, perfect, nodding; alpine or subalpine dwarf .... 1. *T. alpinum.*
- Flowers in a panicle; tall plants, mostly of the foothills and middle altitudes.
  - Flowers perfect; achenes stiped .... 2. *T. sparsiflorum.*
  - Flowers dioecious; achenes not stiped or scarcely so.
    - Achenes broad, strongly oblique both ventrally and dorsally; common.
      - Sides of achene 3 or 4-ribbed .... 3. *T. fendleri.*
      - Sides of achene with branching nerves, at most 1-ribbed .... 4. *T. polycarpum.*
    - Achenes narrow, scarcely oblique; rare .... 5. *T. occidentale.*

1. **T. alpinum** L. Stems 3 to 6 inches high; leaves basal, short petioled, 1 to 1½ inches long, ternate, the lateral divisions with 3, the terminal with 5 leaflets; leaflets notched, 3-cleft or -divided, 1½ to 2 lines long; flowers in a simple raceme, perfect, purplish, nodding; achenes slightly flattened, sessile, 4 or 5-ribbed on the sides, 1 to 1¼ lines long.

Cottonwood Creek, White Mts., acc. *Coville.* Nevada to Colorado, north to the Arctic. Circumpolar. It is probable that this species once occupied most of the northern hemisphere south of the great glaciers.—Avebury. Brit. Fl. Plants, 49.

Refs. THALICTRUM ALPINUM L. Sp. Pl. 1:545 (1753), type European; Cov. Contrib. U. S. Nat. Herb. 4:55 (1893).

2. **T. sparsiflorum** Turcz. Stems erect, slender, 2 to 2½ feet high; flowers perfect, few in a narrow panicle; leaflets small (6 to 10 lines long); ovaries densely and minutely glandular; achenes very minutely glandular-dotted, shortly stiped, 2½ lines long, 1¼ to 1½ lines wide, strongly oblique (half-obovate), with the dorsal angle straight, the sides with 3 or 4 veins curving upward and inward from the base and more or less branching above.

High mountains, 5000 to 9500 feet: San Bernardino Mts. and Sierra Nevada. East to the Rocky Mts., north to Alaska. Asia.

Locs.—Mt. San Gorgonio, *Geo. B. Grant;* Poison Meadow, Tulare Co., *Jepson* 1126; Pine Ridge, Fresno Co., *Hall & Chandler* 142; upper San Joaquin River, Madera Co., *Congdon;* Truckee, *Heller* 7056; Pine Creek, Lassen Co., *Baker & Nutting.*

Ref.—THALICTRUM SPARSIFLORUM Turcz.; F. & M. Ind. Sem. Petrop. 1:40 (1835), type Asiatic.

3. **T. fendleri** Engelm. Stems 2 to 3 feet high; herbage glabrous; leaflets roundish, 5 to 8 lines long, incised or crenate, the teeth mostly rounded but apiculate; panicle 3 to 6 inches long or with accessory panicles from the upper axils; sepals mostly white-scarious, elliptic to ovate, mostly obtuse; achenes 2 to 3 lines long, 1 to 2 lines broad, irregularly oval in outline, more oblique ventrally, the sides 3 or 4-nerved or -ribbed, the central nerve most prominent, the lateral often branched, or merely with irregular branching nerves on the sides.

Sierra Nevada and mountains of Southern California, mostly at higher altitudes. East to New Mexico. The number, development, and branching of the nerves on the sides of the achene is so variable that this character must be used with caution.

Locs.—Golden Trout Creek, Tulare Co., *Jepson* 4933; Nellie Lake, Fresno Co., *A. L. Grant* 1078; Stubblefield Cañon, Yosemite Park, *Jepson* 4539; Summit, Nevada Co., *Jepson.*

Var. **hesperium** Jepson n. comb. Inflorescence and achenes very sparsely glandular-puberulent; achenes flattened.—California, range of the species and passing into it, perhaps scarcely worth definition: Glen Alpine, *Katharine Chandler;* Round Mdw., Giant Forest, *Jepson* 710.

Refs.—THALICTRUM FENDLERI Engelm.; Gray, Mem. Am. Acad. 4:5 (1849), type loc. Mora Creek, New Mexico, *Fendler.* Var. HESPERIUM Jepson. *T. hesperium* Greene, Pitt. 2:24 (1889). *T. fendleri* var. *platycarpum* Trel. Proc. Bost. Soc. Nat. Hist. 23:304 (1883), based on California material; not T. platycarpum Hook. & Th.

4. **T. polycarpum** Wats. Stems 2 to 3 (or 6) feet high; herbage glabrous throughout; leaflets rather prominently veined beneath; sepals elliptic to ovate, mostly acute; achenes many, somewhat inflated, the sides marked with anastomosing veins and mostly with a salient rib down the middle.

Coast Ranges and Southern California, mostly of the foothills or of lower altitudes.

Locs.—Van Duzen River Valley, *Tracy* 2679; Ross Valley, Marin Co., *Jepson;* Berkeley, *Jepson;* Niles, *Jepson;* Crystal Springs Lake, *C. F. Baker* 692; Nacimiento River, *Jepson* 1696; Santa Maria, *Ida M. Blochman;* Arroyo Seco, San Gabriel Mts., *Peirson* 53; Palomar, *Jepson* 1503*a*; San Diego, *Abrams* 3423.

Var. **caesium** Jepson n. comb. Glaucous throughout; achenes less turgid, the sides simply with anastomosing veins.—Central and northern Sierra Nevada foothills and lower altitudes. Perhaps better regarded as identical with the species, but in any event illustrated by the following: near Chico, *Greene;* Calaveras Co. (acc. *Greene*); Hetch-Hetchy, *Jepson* 3643 (Black Oak opens).

Refs.—THALICTRUM POLYCARPUM Wats. Proc. Am. Acad. 14:288 (1879); Jepson, Fl. W. Mid. Cal. 202 (1901). *T. fendleri* Engelm. var. *?polycarpum* Torr. Pac. R. Rep. 4:61 (1857), as to Napa Valley plants. *T. ametrum* Greene, Muhl. 5:129 (1909), type loc. seaward Coast Range. *T. mendocinum* Greene, l.c., type loc. Round Valley, *Chesnut;* achenes nearly veinless. —Ex. char. *T. latiusculum* Greene, l.c., 130, type loc. Mt. Sanhedrin, *Heller* 5855. *T. magarum*

Greene l.c., type loc. Witch Creek, San Diego Co., *Alderson*. Var. CAESIUM Jepson. *T. caesium* Greene, Fl. Fr. 309 (1892), type loc. Sierra foothills, *Greene;* cf. K. Brandegee, Zoe, 4:81 (1893).

5. **T. occidentale** Gray. Leaflets 1 to 2 inches long; achenes few, lanceolate or oblong-lanceolate, acuminate, scarcely oblique, 3 to 4 lines long, $\frac{3}{4}$ to 1 line wide, the sides with 3 prominent ribs or nerves.

Moist shady places, extreme northern California. North to British Columbia, thence east to the Atlantic. Rare with us.

Locs.—Plumas Co. (acc. Syn. Fl. 1^1:16); Wooley Creek, w. Siskiyou Co., *Butler* 359.

Ref.—THALICTRUM OCCIDENTALE Gray, Proc. Am. Acad. 8:372 (1872), type from Ore., *E. Hall*.

12. MYOSURUS L.

Dwarf annuals with entire tufted basal leaves and naked 1-flowered scapes. Flowers whitish or yellowish, small ($1\frac{1}{2}$ to 2 lines broad). Sepals 5, spurred at base. Petals 5, with a nectar-bearing hollow at the summit of the slender claw. Stamens 5 to 20. Achenes numerous, crowded on a long and slender spike-like receptacle. Ovules attached near the summit of the cell.—Species 7, all continents. (Greek mus, a mouse, and oura, a tail, in allusion to the curious receptacles.)

Flowers raised on scapes; achenes with an appressed beak.
  Back of achene narrow, its keel ending in a straight or spreading subulate beak .... 1. *M. aristatus.*
  Back of achene rhomboidal, flattish, its low keel ending in a short or nearly obsolete beak .... 2. *M. minimus.*
Flowers sessile in a close cluster on the ground, or shortly scapose; achenes with a spreading beak .... 3. *M. alopecuroides.*

1. **M. aristatus** Benth. Scapes several, $\frac{3}{4}$ to $1\frac{3}{4}$ inches high; leaves mostly shorter than the scapes; petals present or wanting; spike-like receptacles 2 to 4 lines long; achenes thin-walled, the narrow back continued into a subulate straightish or spreading beak.

Mountains of the western United States. Occurring in extreme northern California; also in Bear Valley, San Bernardino Mts. (acc. *Parish*).

Var. **lepturus** Jepson n. comb. More slender, 1 to 3 inches high; carpels beakless or very short-pointed; carpel-spike 3 to 8 lines long.—Range of the species: Livermore and Sacramento valleys (acc. Greene, Fl. Fr. 296).

Refs.—MYOSURUS ARISTATUS Benth. in Hook. Lond. Jour. Bot. 6:458 (1847), type loc. Camas Prairie, Coeur d'Alene, Ida., *Geyer* 332; (cf. a paper by Tidestrom on this species, Torreya 16:228–230, fig. 1,—1916). *M. apetalus* of N. Am. authors, not of Gay; Parish, Zoe 4:161 (1893). Var. LEPTURUS Jepson. *M. apetalus* var. *lepturus* Gray, Bull. Torr. Club 13:2 (1886), based on spms. from n. Cal., *Lemmon,* and Ore., *Howell.*

2. **M. minimus** L. MOUSE TAIL. Scapes 2 to 6 inches high, the slender spike-like receptacles $\frac{1}{2}$ to $1\frac{3}{4}$, commonly about 1 inch long; leaves linear-filiform, 1 to 2 inches long; mature achenes with somewhat rhomboidal back and very low keel ending in a straight appressed or rarely obsolete tip.

Low ground: inner Coast Ranges; Sacramento and San Joaquin valleys; far eastward. Back of achene broader than in the preceding.

Locs.—Tulare, *Davy* 3083; Mt. Eden, Alameda Co., *K. Brandegee;* lower San Joaquin, *Bioletti;* Vacaville, *Greene;* Haas Slough, Solano Co., *Jepson;* Dixie Mts., Lassen Co., *M. S. Baker;* Modoc Co., *R. M. Austin.* The plant from Livermore Valley (*Greene*), cited by Huth as the type of M. breviscarpus var. californicus Huth in Engler, Bot. Jahrb. 16:285 (1893) probably should be listed here.

Var. **apus** Greene. Spike-like receptacles nearly or quite sessile in a cluster amongst and shorter than the leaves.—Lower San Joaquin Valley; San Diego Co.; Lower California. This variety is referred to M. sessilis Wats. (type loc. Umatilla Co., Ore.) by Huth (Engler, Bot. Jahrb. 16:285,—1893). We have seen no specimens of M. sessilis from Oregon.

Var. **filiformis** Greene. Scapes 1 to 6 inches high; receptacles not tapering, very slender, almost thread-like.—San Francisco and Antioch, acc. *Greene.*

Refs.—MYOSURUS MINIMUS L. Sp. Pl. 284 (1753), type European; Jepson, Fl. W. Mid. Cal. 198 (1901). *M. major* Greene, Pitt. 3:257 (1898), type loc. Yreka, *Greene* (recognized by J. C. Nelson, Torreya, 18:194,—1918). Var. APUS Greene, Bull. Cal. Acad. 1:277 (1885), type loc. mesas, San Diego, *Orcutt*. Var. FILIFORMIS Greene, l.c., type loc. Guadaloupe Isl., *Greene*.

3. **M. alopecuroides** Greene. Leaves 1 line wide, ½ to 2½ inches long; spike-like receptacle slender-conical, rather thick, 3 or 6 to 10 lines long, sessile or very shortly scapose, in clusters of about 4 to 9; achenes not flattened on the back, thin-walled and with prominent spreading beak.

Shallow vernal pools of alkaline flats: western side of the lower Sacramento and lower San Joaquin valleys. Mar.-Apr.

Locs.—Vacaville, *Jepson*; Antioch.

Refs.—MYOSURUS ALOPECUROIDES Greene, Bull. Cal. Acad. 1:278 (1885), type loc. Antioch, *Curran*; Jepson, Fl. W. Mid. Cal. 198 (1901).

13. **RANUNCULUS** L. BUTTERCUP. CROWFOOT.

Annual or perennial herbs with divided or entire leaves. Flowers solitary or somewhat corymbed, yellow, or less commonly white, rarely pink. Sepals 5, rarely 4 or 3. Petals 5 (rarely 1 or 3) to 16, with a little nectar-bearing pit at base, the pit commonly covered by a scale. Stamens usually numerous. Achenes numerous, in a globular or oblong cluster. Seed attached near the base of the cell.—Species about 250, all continents. (Latin name for a little frog, some species growing in wet places where frogs are found.)

Variation Note.—The leaves are always variable in shape or size on a given individual, commonly markedly so. In our species the petals are commonly 5, or varying to 6 or 7, except in R. californicus and R. canus, which have many petals. R. hebecarpus has only 1 to 3 petals.

Ecolog. Note.—Our species, for the most part, grow in the moist vernal beds of winter pools, on the margins of streams or rivulets, or in swamps or wet meadows. A few are amphibious and float in water but none are characteristic of arid places except R. andersonii, which inhabits sagebrush slopes of the great interior plateau. R. californicus should be mentioned in this connection. While it grows in a variety of moist and low habitats, where it produces a corresponding number of indefinable leaf forms, the prevailing form abounds on the open slopes of the coast hills. It is a tropophyte, our only species which has accommodated itself to the dry naked hills, but its period of development corresponds to the months of the winter and spring rains when the soil is continuously moist. It is, furthermore, not only our most abundant but our most variable species. In drier regions, i.e., towards the interior, it is less common on the hills and favors low ground; likewise, in Southern California, it is all but confined to cienagas and wet swales. One may also note Ranunculus hebecarpus which is enabled to tolerate the dryness of the soil where it grows by favoring exclusively the shade of oak or other trees in open woods of the drier foothills.

A. Nectar-bearing pit on petal claws covered with a scale.

1. *Achenes with a firm close coat, not loose or utricular.*—Subgenus EURANUNCULUS.

Aquatic; perennials.
Leaves finely dissected .... 1. *R. delphinifolius.*
Leaves cordate, entire .... 2. *R. hydrocharoides.*

Terrestrial plants, often in muddy or marshy places, but not truly aquatic or floating.
Achenes not spiny-muricate, nor with hooked hairs.
Leaves simple, entire; achenes thickish.
Perennials; petals 5, medium to showy; achenes not papillate.
Stems erect or ascending from a cluster of fibrous roots, not rooting at the nodes.
Leaves glabrous or slightly hairy; stems mostly leafy; achenes turgid, glabrous 3. *R. alismaefolius.*
Leaves mostly densely pilose; stems naked or nearly so; achenes turgid, pubescent .... 4. *R. lemmonii.*
Stems filiform, creeping or decumbent, rooting at the nodes .... 5. *R. flammula.*
Annuals; basal leaves ovate; petals 1 to 3, minute; achenes papillate .. 6. *R. pusillus.*

Leaves (or some of them) toothed, lobed or divided.

Herbage glabrous or nearly so; achenes thick or plump.

Perennials; low plants; alpine or northern.

Basal leaves nearly or quite as broad as long, rounded or truncate at base, 3-lobed at apex or entire .... 7. *R. glaberrimus.*

Basal leaves broader than long, subcordate, 3 (or 5) -parted and coarsely toothed .... 8. *R. eschscholtzii.*

Annuals; stems fistulous .... 9. *R. sceleratus.*

Herbage pubescent or hirsute; leaves lobed or divided, mostly compound; perennials.

Beak of the achenes commonly curved, much shorter than the body, rarely as long.

Stems commonly rather coarse, mostly erect and rather tall; achenes strongly flattened.

Corolla pale or whitish, very small; beak of achene like a grab-hook .... 10. *R. bongardii.*

Corolla golden, showy; sepals reflexed.

Beak deltoid, slightly curved at the acute tip; petals 5 to 10 .... 11. *R. canus.*

Beak narrowly or broadly subulate, not deltoid.

Petals 9 to 16; beak very short, stoutish, rather closely recurved .... 12. *R. californicus.*

Petals 5 or 6; beak rather slender, falcate-curved but more or less erect .... 13. *R. occidentalis.*

Stems creeping or reclining; achenes roundish or turgid, the beak curved or, if straight, at least hooked at tip; sepals not reflexed.

Corolla showy; achene margined; beak somewhat recurved .. 14. *R. repens.*

Corolla small; achene not margined; beak nearly straight .. 15. *R. macounii.*

Beak of the achenes straight, as long as the body; sepals reflexed; stems spreading or ascending.

Leaflets toothed or laciniate.

Petals 5, emarginate; leaflets crenate, mostly not lobed .... 16. *R. bloomeri.*

Petals 5 to 8, rounded at apex; leaflets deeply 3-cleft or laciniate .... 17. *R. orthorhynchus.*

Leaflets or their divisions with entire margins, not serrate or laciniate .... 18. *R. marmorarius.*

Achenes prickly or with stiffish hooked hairs; annuals.

Flowers minute; achenes with hooked hairs; delicate plant .... 19. *R. hebecarpus.*

Flowers medium; achenes spiny-muricate, with raised border.

Leaves cleft into 3 to 5 lobes, the lobes toothed; border of achene beveled, not spiny .... 20. *R. muricatus.*

Leaves deeply 2 or 3 times divided; border of achene spiny .... 21. *R. arvensis.*

2. *Achenes utricular or with a thin coat; perennials.*

Leaves much dissected; flowers pink; achenes strongly inflated.—Subgenus CRYMODES .... 22. *R. andersonii.*

Leaves cordate, lightly crenate; flowers yellow; achenes thin-walled, striate; receptacle elongated-oblong; stems creeping.—Subgenus HALODES .... 23. *R. cymbalaria.*

B. Nectar-bearing pit on petal claws naked; leaves or some of them filiform-dissected; flowers white; aquatic.—Subgenus BATRACHIUM.

Leaves immersed, all filiform-dissected, or rarely some floating leaves 3-parted into broad rounded lobes .... 24. *R. aquatilis.*

Leaves floating, with 3 broad divergent narrowly ovate lobes, or some submersed leaves capillary-dissected .... 25. *R. lobbii.*

1. **R. delphinifolius** Torr. YELLOW WATER CROWFOOT. Aquatic perennial; stems fistulous, 1 to 2 feet long; leaves three or four times ternately dissected into linear-filiform acuminate segments; flowers golden-yellow, showy (8 to 13 lines broad), on naked fistulous peduncles ¾ to 2¼ inches long; petals 5 or 6, broadly obovate; scale of the nectary pit prolonged upwards into narrow or broad wings attached by one edge to the petal and often with free tips, the whole structure conspicuous, ¼ to ⅓ as long as the petal, but apparently variable in form and size; achenes turgid, callous-margined at base and ventrally with a tumid ridge, ¾ line long, the subulate beak over half as long.

Stagnant ponds or pools or slow-flowing streams: Humboldt Co.; Modoc Co. North to British Columbia, east to the Atlantic. Siberia. Rarely collected in California.

Locs.—Grouse Creek, Humboldt Co., *Chesnut & Drew*; ne. Modoc Co., *Manning* 126.

Refs.—RANUNCULUS DELPHINIFOLIUS Torr.; Eaton, Man. ed. 2. 395 (1818), type loc. presumably e. U. S. *R. multifidus* Pursh, Fl. 736 (1814), not Forsk.

2. **R. hydrocharoides** Gray. Aquatic perennial; stems rather slender, sparingly branched above, 3 to 8 inches high from a coarse but short vertical rootstock, which also produces creeping stems; leaves mostly basal, these long-petioled, simple, ovate to cordate, entire, undulate and somewhat callous-margined, 5 to 12 lines long, a little succulent; flowers 2½ to 3½ lines broad; upper leaves obovate or spatulate; achenes ¾ line long.

Marshes and springs: Owens Valley, acc. *Gray*; (?) Dead Horse Cañon, Siskiyou Co., *M. S. Baker* (leaves 1 to 1¾ inches long). Arizona to Mexico. Aspect suggestive of a small Sagittaria.

Refs.—RANUNCULUS HYDROCHAROIDES Gray, Pl. Thurb. 306 (1854), type loc. Mabibi, Sonora, Mex., *Thurber*; Syn. Fl. 1¹:26 (1895).

3. **R. alismaefolius** Geyer. Stems stout, somewhat fistulous, erect, sparingly branched above, several-flowered, 8 to 18 inches high, arising from a short perennial rootstock bearing thick-fibrous roots; herbage glabrous, rarely a little hairy; leaves oblong-lanceolate or lanceolate, 2½ to 6 inches long, mostly 5 to 8 (or 12) lines broad, tapering to apex, and at base usually tapering gradually into the petiole, the basal and lower leaves long-petioled, the upper shortly petioled or sessile, entire or commonly a few on a plant obscurely serrulate; flowers 8 to 10 lines broad; petals 5, roundish obovate; achenes smooth, glabrous, turgid, 1 line long, with a short-subulate introrse beak.

Swamps in Mendocino and Humboldt cos. North to British Columbia and Idaho.

Locs.—Long Valley, *Bolander* 4730; Burr Valley, Buck Mt., *Tracy* 4155.

Var. **hartwegii** Jepson n. comb. Stems slender, not fistulous, ascending, 3 to 13 inches high, usually a little leafy, simple or sparingly branched, but umbellately 3-flowered at summit; stems and petioles hairy or glabrous; leaves lanceolate or oblong-lanceolate, 1 to 4 inches long, tapering gradually into the petiole or the uppermost sessile or nearly so; petioles about half as long as the blade, rarely longer; flowers 5 to 8 lines broad; achenes with short-filiform or slender beak.—Higher altitudes (4500 to 9000 feet) in the Sierra Nevada from Tuolumne Co. north to Siskiyou Co., thence southwesterly to northern Trinity Co. This variety passes into var. alismellus, although the two in their extreme forms are quite different.

Locs.—Sonora Pass, *A. L. Grant* 147; Twin Lakes, Alpine Co., *Hansen* 1306; Lake Tahoe, *Anna King*; Prosser Creek, *Sonne*; Big Mdws., Plumas Co., *R. M. Austin*; Lassen Peak, *Jepson* 4091; Modoc Co., *M. S. Baker*; Medicine Lake, Siskiyou Co., *M. S. Baker*; Goosenest Mt., *Butler* 1322; Salmon Mts., *Hall* 8617.

Var. **alismellus** Gray. (Fig. 106.) Leaves thin, mostly or usually wholly basal, these and the stems in dense tufts; stems 2 to 10 inches high, commonly simple and 1-flowered, naked or 1 or 2-leaved; herbage glabrous, sometimes slightly hairy at base; leaves ovate to oblong-lanceolate, 4 to 12 lines long, on petioles as long or longer, the few stem leaves nearly sessile; flowers 3 to 6 lines broad.—Alpine or subalpine wet meadows or shallow streamlets, 7000 to 10,500 feet, often filling gravelly meadows with golden bloom: Sierra Nevada; far North Coast Ranges; high mountains of Southern California. July.

Locs.—In its most extreme form this is a plant with the leaves all basal in a dense compact even tuft and the strictly naked simple 1-flowered scapes rising an inch or two above them; the leaves are mostly broad (ovate, oval or elliptic), with the blade clearly defined from the petiole. Such plants are rather characteristic of sloping gravel drifts with trickling water ("snow runs") or wet sandy meadows, as for example about Smedberg Lake, Yosemite Park (*Jepson* 3380). More commonly the scapes are sparingly leafy but only 1-flowered, rarely 2 or 3-flowered. The following specimens verify the range of var. alismellus.—Sierra Nevada: Lassen Peak, *Jepson* 4095; Donner Pass, *Heller* 7010; Yosemite Park, *Jepson* 4503 (Benson Pass), 3232, 3236 (Vogelsang Pass); Huntington Lake, Fresno Co., *A. L. Grant* 1030; Mt. Silliman, *Jepson* 748; East Fork Kern River, *Jepson* 5048; Templeton Mt., Tulare Co., *Jepson*

4975. North Coast Ranges: Trinity Summit, *Jepson* 2106; South Yollo Bolly, *Jepson*. Southern California: Bear Valley, San Bernardino Mts., *Parish* 3693; Mt. San Jacinto, *Hall* 2405.

Refs.—RANUNCULUS ALISMAEFOLIUS Geyer; Wats. Proc. Am. Acad. 14:289 (1879); Geyer's Idaho material at Kew (Herb. Benth.) is taken by us as the type; we noted while at Kew that it has an excellent match in *Abrams* 579, Paradise Creek, Latah Co., Ida. *R. bolanderi* Greene, Bull. Cal. Acad. 2:58 (1886), type loc. Long Valley, central Mendocino Co., *Bolander* 4730. Var. HARTWEGII Jepson. *R. hartwegi* Greene, Erythea, 3:45 (1895), based on *R. alismaefolius*, var. Benth. Pl. Hartw. 295 (1848), type loc. Bear Valley, Nevada Co., *Hartweg* 1627; (in Sierran specimens the petioles and stems may be hairy or glabrous, even on the same plant). Var. ALISMELLUS Gray, Proc. Am. Acad. 7:327 (1868), type loc. Yosemite Park (Lake Tenaya and Mt. Dana, *Bolander*). *R. alismellus* Greene, Fl. Fr. 297 (1892).

4. **R. lemmonii** Gray. Perennial; stems scape-like, 4 to 7 inches high, these and the leaves from a small short or globose rootstock bearing numerous stoutish fibres; scapes glabrous, simple or 3-branched near the ground or midway, with a pair of opposite bracts or leaves below the middle; leaves lanceolate, pilose, 1½ to 3½ inches long, drawn down to petioles as long or nearly (and strongly dilated at base); flowers 6 to 9 lines broad, solitary on the scape or its scape-like branches; petals 5, rarely 6 or 7, obovate or oblong; achenes in a globose head, very turgid, minutely pubescent, the beak very short.

Dry plains or valleys in the mountains, eastern slope of the Sierra Nevada in Sierra and Nevada cos., 5000 feet. May. Very nearly related to R. alismaefolius var. hartwegii.

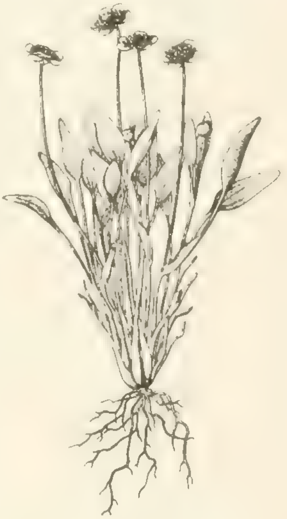

Fig. 106. RANUNCULUS ALISMAEFOLIUS Geyer var. ALISMELLUS Gray. Plant, × ½.

Locs.—Sierra Valley; Truckee, *Sonne*.

Ref.—RANUNCULUS LEMMONII Gray, Proc. Am. Acad. 10:68 (1874), type loc. Sierra Valley, *Lemmon*.

5. **R. flammula** L. SPEARWORT. Perennial; stems slender or almost filiform, decumbent or creeping, rooting at the nodes, 3 to 13 inches long; leaves lanceolate, linear- or oblong-lanceolate or oblong-ovate, entire, ½ to 1¾ inches long, tapering into petioles ½ to 2½ inches long, or sometimes sessile; flowers 2 to 5 lines broad, terminating leafy stems or naked scape-like peduncles 1 to 2 inches high; achenes comparatively few, thick, less than ½ to 1 line long, the beak short.

Margins of lakes or shallow slow meadow-streamlets: North Coast Ranges; Sierra Nevada at middle altitudes; San Bernardino Mts. July.

Locs.—North Coast Ranges: Pt. Reyes, *Jepson* 1167; Mt. Hanna, Lake Co., *Jepson*; Ft. Bragg, *W. C. Mathews*; Humboldt Bay, *Chandler* 1130; Shackelford Creek, w. Siskiyou, *Butler* 1741; Sisson, *Jepson*. Sierra Nevada: Goose Lake, *Austin & Bruce*; Prattville, *T. Brandegee*; Bear Valley, Nevada Co., *Jepson*; Placer Co., *Hardy*; Silver Lake, Amador Co., *Hansen* 552; Hetch-Hetchy, *A. L. Grant* 882; Yosemite Valley, *Hall* 9086; Dinkey Creek, Fresno Co., *Hall & Chandler* 400. Southern California: Little Bear Valley, San Bernardino Mts., *Chandler*.

Refs.—RANUNCULUS FLAMMULA L. Sp. Pl. 548 (1753), type European. Var. *intermedius* and var. *reptans* Gray, Syn. Fl. 1^1:26–27 (1895), as to U. S. Pacific Coast plants. The leaves are very variable in form, even in one collection or on one individual, and the ample Californian material before us must be taken as one thing. *R. intermedius* Heller, Bull. Torr. Club, 25:580 (1898), as to Pacific Coast plants.

R. SAMOLIFOLIUS Greene, Pitt. 3:13 (1896), "higher Sierra Nevada from Mt. Shasta southward." Stems half-reclining, leafy throughout, 1-flowered; leaves entire, oblanceolate, long-petioled, 2 to 4 inches long, the cauline oval or obovoid (ex. char.). This may be nearer R. hydrocharoides Gray than R. flammula L.

6. **R. pusillus** Poir. Dwarf Spearwort. Slender annual, 3 to 11 inches high; herbage glabrous or the dilated petiole somewhat sparingly villous-ciliate; basal leaves round-ovate to ovate, toothed or entire, 3 to 8 lines long, on elongated petioles; cauline leaves elliptic-oblong to linear-lanceolate, entire or slightly denticulate, ¾ to 2 inches long, more shortly petioled; flowers minute; sepals subscarious, mostly not reflexed; petals commonly 1 to 3, ¾ line long; achenes numerous in a small globose head, papillate, ½ line long, the beak very minute.

Low wet ground or in shallow pools, North Coast Ranges (Marin Co. to Humboldt Co.). Eastern United States. Apr.-May. Cattle do not eat it.

Locs.—Between Olema and Bolinas, *T. Brandegee;* Sonoma, *R. Kuhn;* Howell Mt., *Tracy* 1531; Calistoga, *Jepson* 9180; Willits, *Davy & Blasdale;* Alder Pt., Eel River, *Davy* 1912.

Refs.—Ranunculus pusillus Poir. in Lam. Encyc. 6:99 (1804), type from the Carolinas; Jepson, Fl. W. Mid. Cal. 199 (1901). Var. *lindheimeri* Gray, Proc. Am. Acad. 21:367 (1886); Jepson, Fl. W. Mid. Cal. ed. 2, 170 (1911). *R. trachyspermus* var. *lindheimeri* Engelm. Pl. Lindheim. 1:3 (1845), type loc. Houston, Tex., *Lindheimer. R. biolettii* Greene, Pitt. 2:225 (1892), type loc. Shellville, Sonoma Co., *Bioletti.*

7. **R. glaberrimus** Hook. Perennial; stems 3 to 7 inches high, 1 to 3-flowered, these and the basal leaves from a cluster of slender-fusiform roots; herbage glabrous, somewhat succulent; basal leaves roundish to oval, obtuse or truncate at base, 3-lobed at apex, or entire, ½ to 1¼ inches long, on petioles 3 to 4 times as long; cauline leaves few, 3-lobed or 3-parted, short-petioled or subsessile; flowers golden-yellow, sometimes aging white, ¾ to 1¼ inches broad; achenes plump, with roundish back, ¾ line long, the short beak slender-subulate, straight.

Moist flats: Lassen, Modoc and Siskiyou cos. North to British Columbia and east to Colorado.

Locs.—Milford, Lassen Co., *M. S. Baker;* Alturas, *L. S. Smith* 915; Ft. Bidwell, *Manning* 54; Big Valley, Modoc Co., *M. S. Baker;* Goose Lake, *Austin & Bruce;* Shasta River Cañon, *Butler* 1117.

Refs.—Ranunculus glaberrimus Hook. Fl. Bor. Am. 1:12, t. 5, fig. A (1829), Kettle Falls (Columbia River) and Rocky Mts., *Douglas. R. ellipticus* Greene, Pitt. 2:110 (1890). *R. glaberrimus* var. *ellipticus* Greene, Fl. Fr. 298 (1892). *R. austinae* Greene, Erythea, 3:44 (1895), type loc. crevices in high bluffs of lava rock east of Willow Creek Valley 30 miles w. of Goose Lake, *R. M. Austin.*

8. **R. eschscholtzii** Schlecht. Perennial; stems and leaves in a dense tuft on a very short vertical rootstock which bears a fascicle of fibrous or thickened roots; stems erect, 4 to 6 (or 10) inches high; herbage glabrous, the calyx slightly hairy; basal leaves 6 to 15 lines broad, broader than long but roundish or reniform in outline, subcordate at base, unequally 3-cleft or -parted, the smaller central lobe obovate, entire, or 3-toothed, the lateral mostly 3-cleft, rarely all the lobes alike, but all the apices acute; petioles 1 to 2 inches long; cauline leaves few, similar or pedately 3-cleft, short-petioled; peduncles terminal, naked, ½ to 1 (or 2½) inches long; flowers golden-yellow (often aging dull white), 4 to 9 lines broad; petals round-obovate; achenes thickened, glabrous, smooth, somewhat carinate on the back, the beak short, recurved; receptacle oblong, 4 to 5 lines long.

Subalpine, in gravelly or rocky surface streamlets on cool mountain slopes, 9000 to 13,700 feet; central and southern Sierra Nevada from Nevada Co. to Tulare Co.; White Mts.; San Bernardino and San Jacinto mountains. Western Nevada. North to Alaska.

Geog. Note.—This species is apparently absent from the northern Sierra Nevada, Mt. Shasta, the Coast Ranges and the Oregon Cascades. The plants of the high Sierras are, in habit, foliage and flowers, at one with Oregon plants distributed as R. eschscholtzii Schlecht. by many capable botanists and so described in local floras. The achenes of the California plants are turgid when well-developed, certainly not "compressed," although sometimes slightly carinate, but often no more so than in northern specimens. At best this single character, so slight and variable, could be of no more than varietal value. If specimens from Iliuliuk, Unalaska, Aleutian Islands (*Jepson* 67), were mixed with specimens from Mt. Lyell, we feel certain that they could not afterwards be segregated into their respective collections. The styles are quite alike in the two and even the faintly tawny shade of the hairs on the upper reduced leaf-sheaths is the same. The peduncles vary in length but they are often as short as in Alaskan specimens. Therefore we quote here: Piute Mt., Yosemite Park, *Jepson* 4579; Vogelsang Pass, *Jepson* 3226; Mt. Lyell, *Hall & Babcock* 3651; Mt. San Jacinto, *Hall* 2414. The thicker-leaved plants (var. **oxynotus** Jepson n. comb.) may be listed as follows: Mt. Stanford, Nevada Co., *Sonne*; Stanislaus Peak, *A. L. Grant* 535; Sonora Peak, *A. L. Grant* 401; Kaiser Peak, Fresno Co., *A. L. Grant* 1427; Kearsarge Pinnacles, *Jepson* 850; Mt. Whitney, *Jepson* 1077; Army Pass, *Jepson* 5062; Milestone Creek, upper Kern River, *Jepson* 5033; Alta Mdws., *Hopping* 515; Lost Creek, Sawtooth Range, *Jepson* 4995; Farewell Gap, *Jepson* 1025; Olancha Mt., *Hall & Babcock* 5232; White Mountain Peak, *Jepson* 7384; Mt. San Gorgonio, *Blasdale*.

Refs.—RANUNCULUS ESCHSCHOLTZII Schlecht. Animad. Ran. 2:16, t. 1 (1820), type from the Aleutian Islands, *Chamisso*. Var. OXYNOTUS Jepson. *R. oxynotus* Gray, Proc. Am. Acad. 10:68 (1874), type loc. Castle Peak, Nevada Co., *Lemmon*.

9. **R. sceleratus** L. CURSED CROWFOOT. Annual; stems erect, somewhat fistulous, branching, leafy, 7 to 12 inches high, from a cluster of stout fibrous roots; herbage glabrous or nearly so, somewhat succulent; leaves $\frac{3}{4}$ to $1\frac{1}{2}$ inches broad, parted into 3 (or 5) cuneate segments which are again cleft and coarsely toothed, the ultimate lobes or divisions short-oblong, obtuse; basal leaves long-petioled; uppermost leaves nearly sessile, the segments broadly linear and nearly entire; flowers 3 to 5 lines broad; petals pale yellow, scarcely exceeding the calyx; receptacle elliptic or oblong, $1\frac{1}{2}$ to 4 lines long; achenes thick, $\frac{1}{2}$ line long, the beak almost none.

Shallow pools or muddy margins of lakes of the interior plateau from Oregon to Arizona (thence far northward and eastward), entering California in Modoc Co. Juice acrid, raising blisters on the skin.

Locs.—Pitt River below Goose Lake, *R. M. Austin*. Klamath Falls, Ore., *R. M. Austin*.

Refs.—RANUNCULUS SCELERATUS L. Sp. Pl. 551 (1753), type European. *R. eremogenes* Greene, Erythea, 4:121 (1896), type loc. "West American desert regions."

10. **R. bongardii** Greene. Perennial; stems slender, or often coarse, 1 to 2 feet high; herbage sparsely or densely pilose below, above pubescent or hirsutulose; leaves 3-parted, the divisions shallowly 3-cleft or disposed to be quite entire, rather broad and elongated, especially the upper; flowers small (2 to 3 lines broad), very pale yellow or whitish; achenes elliptic, glabrous, the very slender beak as long as the body, erect-curved like a grab-hook.

Shady woods: Humboldt Co. and northern Sierra Nevada. North to Alaska.

Locs.—Eureka, *Tracy* 1104, 3133; Donner Lake, *Sonne*. Var. **greenei** Piper. Achenes hispidulose.—Kneeland Prairie, Humboldt Co., *Chesnut & Drew*; Eureka, *Tracy* 1137, 2416, 4687; Pine Ridge, Fresno Co., *Hall & Chandler* 131; Little Bear Valley, San Bernardino Mts., *Chandler*.

Refs.—RANUNCULUS BONGARDII Greene, Erythea, 3:54 (1895). *R. tenellus* Nutt.; T. & G. Fl. 1:23 (1838), type loc. Columbia and Willamette rivers, *Nuttall*; not R. tenellus Viviani, Pl. Aegypt. (1831). Var. GREENEI Piper, Contrib. U. S. Nat. Herb. 11:275 (1906). *R. greenei* Howell, Fl. Nw. Am. 1:18 (1897). *R. tenellus* var. *lyallii* Rob. in Gray, Syn. Fl. 1^1:33 (1895). *R. occidentalis* var. *lyallii* Gray, Proc. Am. Acad. 21:373 (1886), type loc. Pen d'Oreille River, Ida., *Lyall*; not R. lyallii Hook.

11. **R. canus** Benth. Perennial; stems erect, branching, 1 to $1\frac{3}{4}$ feet high; herbage fragrant (at least at certain stations, probably not always), soft-villous all over when young or the leaves beneath conspicuously silky-lanate; leaves mostly in a basal tuft, deeply parted and subdivided into many lanceolate acute segments, long-petioled; flowers 6 to 12 lines broad; petals 5 to 8 (or 10); achenes large, flat, glabrous, 2 to 3 lines long, including the rather conspicuous triangular-subulate beak which is slightly curved at the tip.

Plains or low rolling hills: Sacramento Valley south to Contra Costa Co. It passes into R. californicus.

Locs.—Antioch, *Davy* 925; Montezuma Hills, *Platt*; Vanden, Vacaville and Violet, Solano Co., *Jepson* (hardly at all silky); Sweeney Creek, *Jepson* 8254; nw. Solano Co., *Jepson* (dorsal keel of achenes hispidulose); Cannon, *Jepson* 6782; Chico, acc. *Gray*. The var. BLANKINSHIPII Rob. (achenes hispidulose) occurs on the low foothills of western Yolo Co. and western Solano Co.

Refs.—RANUNCULUS CANUS Benth. Pl. Hartw. 294 (1848), type loc. moist valley fields, Butte Co.; Gray, Proc. Am. Acad. 21:374 (1886). The type is *Hartweg* 1626. This number in the Herbarium Benthamianum (Kew) is remarkably silky and we have seen nothing quite like it; but the same number in the Herbarium Hookerianum (Kew) is less hairy and is well matched by the specimens from the Montezuma Hills cited above, which, in turn, grade into plants from other stations. The soft white pubescence is most marked on the early growth. *R. californicus* var. *canus* Brew. & Wats. Bot. Cal. 1:8 (1876). *R. hesperoxys* Greene, Erythea, 2:189 (1894), based on spms. from Antioch and Chico. *R. canus* var. *hesperoxys* Davis, Minn. Bot. Stud. 2:475 (1900); Jepson, Fl. W. Mid. Cal. 200 (1901). Var. BLANKINSHIPII Rob.; Gray, Syn. Fl. 1^1:35 (1895), type loc. Capay, *J. W. Blankinship*. *R. blankinshipii* Heller, Muhl. 1:40 (1904).

12. **R. californicus** Benth. CALIFORNIA BUTTERCUP. Stems mostly caespitose, arising from a cluster of stout fibrous perennial roots, erect or ascending, 9 to 18 inches high, freely branching and many-flowered; herbage hirsute (especially below) to nearly glabrous, the leaves often silky beneath; leaves ovate or roundish in outline, 1 to 2 (or 3) inches long, ternately divided, and again divided, parted or lobed, the earlier with the broad divisions shallowly and mostly obtusely lobed, the later with the laciniately and sharply cleft divisions less broad or narrowly linear; flowers 6 to 11 lines broad; sepals usually somewhat petal-like, closely reflexed; petals 9 to 16, uncommonly as few as 7 or 8, obovate to oblong; achenes glabrous, strongly flattened, nearly as broad as long, $^3/_4$ to $1^1/_2$ lines long, very rounded dorsally, the ventral side straightish; beak very short, mostly stoutish and closely recurved, sometimes slender and slightly recurving.

Open hills and moist valleys, our most common species, abundant in the Coast Ranges and south to Southern California. Also occuring in the Great Valley and neighboring foothills but localized or less common.

Geog. Note.—The exact, that is detailed geographic limits of this species have not been well worked out and are perhaps not susceptible of sharp topographic definition on account of merging with its varieties and with R. canus and possibly with R. occidentalis. We have never, however, observed a multipetalous buttercup in the Sierra Nevada proper; on the other hand Ranunculus californicus is frequent everywhere in central California and often dominant, coloring leagues upon leagues of grassy hills in the late winter and early spring with its profusion of yellow flowers. We take as typical, for purposes of our diagnosis, the prevailing plant of the central coast hills bearing flowers with many petals. Its small earliest leaves are shallowly 3-lobed, but otherwise entire or sparingly toothed. These are followed by deeply 3-parted leaves, the broad segments again 3-lobed or -cleft, or laciniate-toothed. The larger later leaves are similar, but usually cut up into narrower or linear segments.

The multipetalous R. californicus and the 5-petaled R. occidentalis are so similar in habit, in flower structure and even occasionally in number of petals, and both are so variable as to the beak character of their achenes and as to pubescence, that they cannot in extreme forms be separated except by an arbitrary cleavage. The most highly developed type of each, however, is a distinct unit, and this extreme type represents in each case a wide-spread dominant in exclusive territory. By reason of this consideration and on account of a series of named variants centering around each type, it seems wholly desirable to retain these two as species. The achenes of R. californicus are roundish and very flat, with a stout and very short style, the tip of which is bent backward in such a way as to leave little space between it and the body of the achene. This type of style is, however, not constant, since slender nearly erect styles in one direction and broad styles in the other direction give a considerable range of variation. On the other hand, while the achenes of R. occidentalis are essentially similar to R. californicus, the beak of the achene in R. occidentalis, in its most characteristic form, projects forward, or if recurving lies forward of the median longitudinal line of the achene. This feature is, however, usually not true of its varieties. In the Sierra foothills the var. eisenii exhibits within narrow geographic limits certain beak forms resembling those of R. californicus and other forms which intergrade continuously to R. occidentalis. The narrow-beaked type of achene of R. californicus, therefore, passes by intergrades into those of R. occidentalis, just as the broad-beaked forms of R. californicus undoubtedly pass by continuous intergrades into R. canus. The variability of the achene in this group is therefore in certain respects so considerable that no decisive test can be had from it. So far as the achene character is concerned, var. eisenii of R. occidentalis might be transferred to R. californicus. On the other hand the petal number in var. eisenii indicates definite genetic connection with R. occidentalis. The most dependable character for the segregation of these forms seems to lie in number of corolla parts. The petals of R. californicus vary most commonly from 7 to 16 and we determined the modal value to be 12 which if graphically represented makes a 2-sided figure. The petals of R. occidentalis are 5, varying to 7 or 8, the modal value being 5 and representing a 1 sided figure. This seems to be therefore the soundest test of differentiation between these two species.

Locs.—The following collections are fairly typical of R. californicus: hills west of St. Helena, *Jepson;* Olema, *Jepson;* Berkeley, *Jepson* (compared by us with the type at Kew); San Francisco, *Harriet Walker;* Livermore, *Bioletti;* Mt. Hamilton, *Jepson* 4235; Monterey, *Heller* 6530; San Luis Obispo, *Summers;* Los Angeles, *Braunton* 814; San Bernardino, *Parish.*

Teratology.—A "green-flowered" (teratological) buttercup, usually growing on the blue or most viscous adobe, occurs in abundance and with considerable variety of form on the hills east of Walnut Creek, Contra Costa Co. It occurs likewise in Conn Valley, Napa Co., and also grows freely in San Mateo Co. near Redwood and on the hills of southern Santa Clara Co. Modification affects conspicuously the petaline and sepaline whorls which are more or less virescent or frondescent. Within a few square yards one may commonly find petaline organs varying from normal yellow through greenish yellow to wholly virescent or frondescent. The extreme virescent petaline structures are commonly elliptic to oblong, 2 to 3 (or 4) lines long, and borne on slender claws as long or half as long. This form is noted here principally on account of its frequence.

Var. **cuneatus** Greene. Stems prostrate or decumbent; leaves thin; the lower leaves sharply cleft into 3 broad lobes, the divisions incised but more equally toothed than in the species, so that the outline is roundish-subcordate.—San Mateo to San Francisco and Marin Co.; often on ocean bluffs.

Var. **crassifolius** Greene. Stout, low, the stems assurgent; herbage somewhat succulent, sparingly villous; basal leaves shallowly 3-lobed, the lobes rounded and more or less coarsely toothed; cauline leaves parted into 3 oblong lobes.—Coast bluffs, Mendocino Co. to San Francisco.

Var. **ludovicianus** Davis. Stems many, coarse, rather densely tufted; herbage rather densely pilose or even silky, especially below; leaves cut into rather broad acuminate or lanceolate segments; flowers and achenes of the species.—Mountain meadows, Tehachapi Mts. to the San Bernardino Mts. and San Diego Co., 4500 to 7000 feet.

Locs.—Tehachapi, *Davy* 2164; San Bernardino Mts. (Fawnskin, *Chandler*, Bear Valley, *Parish* 3691); Palomar, *Jepson;* Santa Ysabel, *Jepson* 8523.

Refs.—RANUNCULUS CALIFORNICUS Benth. Pl. Hartw. 295 (1848), type loc. Monterey, *Hartweg* 1628; Jepson, Fl. W. Mid. Cal. 200 (1901). The first three varieties named below appear to be ecological: Var. *latilobus* Gray, Proc. Am. Acad. 21:375 (1886), leaves like the species but with broad divisions, a form of the South Coast Ranges and Southern California, at low altitudes. Var. *laetus* Greene, Fl. Fr. 299 (1892), stoutish and fistulous with broad leaf segments.—San Francisco Bay region, borders of marsh lands. Var. *canescens* Greene l.c., basal parts long-villous; flowers large (ex. char.).—Mt. Diablo Range. The three following varieties seem more stable: Var. CUNEATUS Greene l.c., type loc. San Mateo Co. Var. CRASSIFOLIUS Greene, Erythea, 1:125 (1893), type loc. Ft. Bragg, *C. E. Michener.* Var. LUDOVICIANUS Davis, Minn. Bot. Stud. 476 (1900). *R. ludovicianus* Greene, Bull. Cal. Acad. 2:58 (1886), type loc. Tehachapi Pass, *Curran;* Erythea, 4:65 (1896).

13. **R. occidentalis** Nutt. Perennial; habit of R. californicus; herbage pilose or hirsute below with spreading hairs, often densely so on the petioles, or varying to nearly glabrous; basal leaves of roundish outline, $^3/_4$ to 2 inches broad, incisely 3 (or 5) -cleft or -parted, rarely divided into separate leaflets, the segments mostly broad, shallowly but incisely lobed and toothed; upper cauline leaves divided into linear segments; flower 6 to 10 lines broad; petals 5; achenes flattened, obliquely rounded dorsally, nearly straight on the ventral side, 1 to 2 lines long, the subulate beak saliently erect, straight or somewhat falcate, and commonly projecting somewhat forward rather than recurving, $^1/_3$ to $^2/_3$ as long as the body.

Washington and Oregon. Entering the northern borders of California and occurring mainly as intergrades to the var. eisenii.

Tax. Note.—In the best natural type of the species the beak, whether straight or curving, is disposed to project forward and stand saliently above the ventral angle of the achene, rather than to recurve over the body of the achene. Plants from Siskiyou Co. and southerly to Mendocino Co. and Placer Co. are referred to the species, being the nearest typical of anything found in California: Sherwood Valley, *Davy* 5124; Eureka, *Tracy* 826; Van Duzen River valley opp. Buck Mt., *Tracy* 2689; Placer Co., *Carpenter.*

Var. **eisenii** Gray. Stems slender, erect, 1 to 1½ feet high; stems and leaves pilose with spreading hairs or only the leaves pilose, or the herbage subglabrous; leaves lobed as in the species; flowers 5 to 8 lines broad; petals commonly 5, sometimes 6, rarely 7; beak of the achenes slender, curving, rarely closely recurved.—This is the most widely spread representative of the species in California. It prevails in the Sierra Nevada foothills up to 2500 or 4500 feet and is the common buttercup of openly wooded ridges, flats and valleys. It continues around the foothills of the upper Sacramento Valley and occurs in the inner and middle Coast Ranges, at least as far south as Santa Clara Co. It has commonly a more slender and less strongly recurving beak than in typical R. californicus, but this kind of a beak may often be found in that species. For example, the achenes in specimens of var. eisenii from Los Gatos (*Heller* 7343) match those of R. californicus (of typical habit and multi-petaled) from Mt. Hamilton (*Jepson* 4235). Conversely, the usual form of achene of R. californicus may sometimes occur in var. eisenii, as in specimens from Hetch-Hetchy (*Jepson* 3447). All of which goes to show the weakness of the achene (and especially the beak) character in this section.

Var. **rattanii** Gray. Stems slender, 1 to 2 feet high; pubescence as in var. eisenii; petals 5 or 6; achenes hispidulose, the beak slender, nearly erect or projecting forward a little, or recurved.—Mendocino and Humboldt cos.; north to southern Oregon. Ranges south into Napa Co. in a modified form.

Locs.—Ukiah, *Purdy;* Ft. Seward Ranch ridge, *Jepson* 1895; Alder Pt., *Tracy* 1908; Eureka, *Tracy* 1107½. Grants Pass, Ore., *Howell* (beak slender, nearly as long as the achene).

Series of specimens from the Napa Range (hills east of St. Helena, *Jepson*) show achenes with very variable beaks, sometimes looking towards typical var. rattanii, sometimes exactly typical of R. californicus. The plants grow in closest association with R. occidentalis var. eisenii. Indeed, the two are often collected with roots intertwined and distributed by collectors in the same sheet as if one, which, indeed, they are in nearly all features except the hispidulose achenes. Hispidulose achenes, it may be added, are likely to break out anywhere in the R. californicus-canus-occidentalis series.

Locs.—Sierra Nevada: Limekiln Creek, Tulare Co., *Jepson* 2794; Hetch-Hetchy, *Jepson* 3447; Bear Valley, Nevada Co., *Jepson;* Hat Creek, e. Shasta Co., *Hall & Babcock* 4263. Coast Ranges: Shackelford Cañon, w. Siskiyou Co., *Jepson* 2814; Calistoga, *Jepson;* hills east of St. Helena, *Jepson;* Santa Cruz Mts.

Var. **alceus** Jepson n. comb. Plants diffuse, 6 to 9 (or 15) inches high; stems and petioles very pilose below; flowers small; achenes as in var. eisenii.—Higher altitudes in the north Coast Ranges and Sierra Nevada, (3000 or) 5000 to 7500 feet; a late flowering rather small plant about intermediate between the species and var. eisenii.

Locs.—North Coast Ranges: Elk Mt., *Jepson;* Snow Mt., *T. Brandegee;* Knoxville Ridge, ne. Napa Co., *Jepson* 9044. The following Sierra Nevada specimens are essentially alike and almost if not quite identic with the typical inner North Coast Range plants, the only difference residing in the elongated entire upper leaves or broad leaf divisions of the former: Belle Mdw., Tuolumne Co., *Jepson* 6487; Deadman Creek, Tuolumne Co., *Jepson* 6551; Silver Lake, *Hansen;* Deer Park, *Fox;* Warner Valley, Plumas Co., *Jepson* 4068.

Refs.—RANUNCULUS OCCIDENTALIS Nutt.; T. & G. Fl. 1:22 (1838), type loc. Columbia River plains, *Nuttall.* Var. EISENII Gray, Proc. Am. Acad. 21:373 (1886), type loc. middle Sierra Nevada. Apparently also *R. eisenii* Kell. Proc. Cal. Acad. 7:115 (1876), indefinitely described and the type and type locality not indicated. *R. longilobus* Heller, Muhl. 2:36 (1905), type loc. Middle Creek Sta., near Keswick, *Heller* 7912, is an intergrade from R. occidentalis but nearer var. eisenii. Var. RATTANII Gray, Proc. Am. Acad. 21:373 (1886), type loc. Klamath River, *Rattan;* Jepson, Fl. W. Mid. Cal. 201 (1901). Var. ALCEUS Jepson. *R. alceus* Greene, Erythea, 3:69 (1895), type loc. Elk Mt., Lake Co., *Jepson.*

R. RUGULOSUS Greene, Pitt. 2:58 (1890), type loc. Chowchilla Mts., *F. P. McLean,* stems decumbent; achenes rarely 1 line long, the sides rugose (ex char.).—Perhaps nearest R. occidentalis var. eisenii.

14. **R. repens** L. CREEPING CROWFOOT. (Fig. 107.) Perennial; stems trailing, arising from a cluster of stout fibrous roots, ½ to 1 foot long, rooting at the lower nodes; herbage sparsely bristly, often densely so on the petioles; leaves 1 to 4 inches broad, the basal long-petioled, composed of 3 distinct or nearly distinct leaflets; leaflets incisely 3-parted and again incisely cleft or toothed;

flowers 6 to 12 lines broad; sepals not reflexed; petals much longer than the sepals, brilliant gold; achenes flattened, keel-margined all around, 1 line long, bearing a short stout somewhat curved beak which is bent or hooked at tip.

European species, sparingly naturalized in marshes along the north coast.

Locs.—Berkeley, *Jepson* 9197 (in lawns), 8323a; Bear Valley, Marin Co., *Jepson* 8292 (=var. villosus Lamotte, the hairs wide-spreading); Humboldt Bay.

Refs.—RANUNCULUS REPENS L. Sp. Pl. 554 (1753), type European; Fern. Rhod. 21:169 (1919).

15. **R. macounii** Britt. Perennial; stems stoutish, trailing or reclining, rarely rooting at the nodes, 1 to 1½ feet long; general aspect similar to R. orthorhynchus; stems and petioles hispidly hirsute with spreading hairs; leaves 3-foliolate, incisely 3-cleft, with laciniate and sharply toothed segments; flowers relatively insignificant (4 to 5 lines broad); petals little surpassing the early deciduous sepals; heads of achenes large, dense, globular or somewhat oval; achenes somewhat flattened, carinate-margined all around, 1 to 1½ lines long, with a short-lanceolate straightish beak ½ line long.

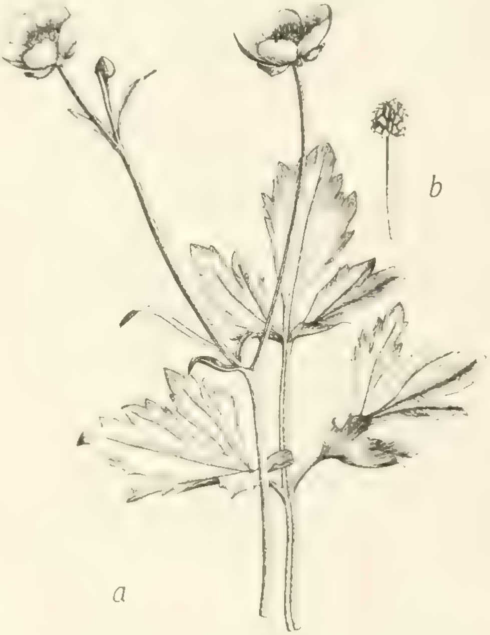

Fig. 107. RANUNCULUS REPENS L. *a*, flowering branchlet and basal leaf; *b*, head of achenes. × ½.

Nevada to Oregon and British Columbia, entering California in Modoc Co. East to the Atlantic.

Locs.—Devils Garden, Goose Lake, *Austin & Bruce*. Truckee Valley, w. Nev., *Doten*.

Refs.—RANUNCULUS MACOUNII Britt. Trans. N. Y. Acad. Sci. 12:3 (1892). *R. hispidus* Hook. Fl. Bor. Am. 1:19 (1829), type loc. British America.

16. **R. bloomeri** Wats. (Fig. 108.) Stems erect or ascending, 5 to 18 inches high, from a cluster of thick-fibrous or even slender-fusiform perennial roots; herbage somewhat succulent, glabrous or a little hairy, especially on the leaf bases; basal leaves 3 foliolate (or a few simple), on petioles 6 to 14 inches long; leaflets (as well as the simple blades) ovate to roundish, obtuse to cordate at base, coarsely dentate, sparsely incised, or 3-lobed, usually petiolulate, ¾ to 2 inches long; flowers few and large, 1 to 1½ inches broad; petals 5, emarginate at apex, the greenish area at base conspicuous and the nectar-gland large; achenes turgid, 1½ lines long, tipped with a slender subulate beak as long.

Low fields near the coast from San Mateo Co. to Contra Costa and Mendocino cos. Feb.-Apr.

Locs.—San Mateo, *Eastwood;* Hillsboro, *Inez Smith;* Mission Hills, San Francisco, *T. Brandegee;* Oakland, *Drew;* Happy Valley, Contra Costa Co., *Gardner;* Olema, *Jepson* 4040; Rutherford, *Jepson;* Calistoga, *C. F. Baker* 1995; Healdsburg, *Alice King;* Long Valley, *Bolander* 4729.

Refs.—RANUNCULUS BLOOMERI Wats. Bot. Cal. 2:426 (1880), type loc. near San Francisco, *H. G. Bloomer;* Jepson, Fl. W. Mid. Cal. 200 (1901).

17. **R. orthorhynchus** Hook. Stems leafy, ascending or erect, ¾ to 1½ feet high, these and the basal leaves from a large cluster of stout-fibrous or slender-fusiform perennial roots; petioles and stems hirsute or villous with spreading hairs; leaves pinnately 5-foliolate, the 3 upper leaflets often approximate; leaflets incisely cleft or toothed, or 3-parted, especially the terminal one, ¾ to 1½ inches long; flowers yellow, 6 to 9 lines broad; petals 5; achene glabrous, thickish, 2 lines long, with a broad ventral channel and weak dorsal keel, the subulate upright beak quite as long as the body.

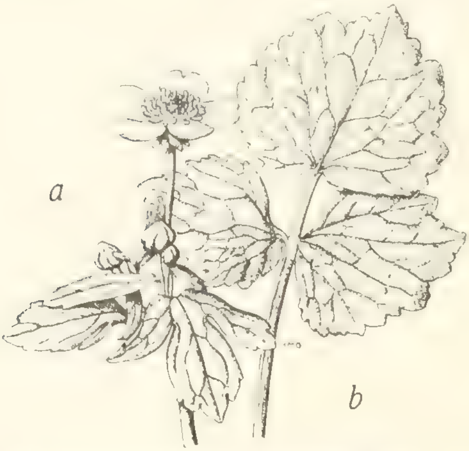

Fig. 108. Ranunculus bloomeri Wats. *a*, flowering branchlet; *b*, blade of basal leaf. × ⅔.

Wet meadows, middle altitudes (3600 to 5600 feet) in the Sierra Nevada, from Mariposa Co. north to Modoc Co., thence west to Siskiyou Co. Far north to British Columbia.

Locs.—Hog Ranch Road, Yosemite Park, *Hall* 8903; Yosemite Valley, *Congdon;* Holtzel Mdw., Mariposa Co., *Congdon;* Confidence, Tuolumne Co., *Jepson* 7705 (leaflets mostly 3); Belle Mdw., Tuolumne Co., *Jepson* 6485; Placer Co., *Hardy;* Bear Valley, Nevada Co., *Jepson;* Hot Springs Valley, Lassen Peak, *Jepson* 4087; Morgan, e. Tehama Co., *Hall & Babcock* 4378; Bear Flat, ne. Shasta Co., *Hall & Babcock* 4157; Modoc Co., *M. S. Baker;* Sisson, *Hall & Babcock* 4066.

Var. **hallii** Jepson n. var. Leaflets of basal leaves broader than long, with mostly shallow lobes and obtuse teeth.—(Foliorum inferiorum foliolata latiora quam longa, lobis vulgo non profunde et dentibus vulgo obtusis.)—Pine Ridge, Fresno Co., *Hall & Chandler* 236 (type). The achenes are rather sharply margined, these margins running out onto the stout beak as sharp salient ridges. The leaflets are suggestive of those of Apium graveolens.

Var. **platyphyllus** Gray. Stems very stout, (½ or) 1½ to 3½ feet high, from a cluster of slender fusiform roots; herbage brownish-hirsute or pilose, the hairs often retrorse and often dense on the petioles, or nearly glabrous throughout; leaves 3-foliolate (or the cauline ternately divided), the basal long-petioled; leaflets 1 to 2 (or 4) inches long, mostly broad, 3-parted or laciniately or sharply cleft and toothed, or with all or, more commonly, only the terminal leaflet replaced by 3 leaflets; lateral leaflets sessile or short-petiolulate, the terminal one long-petiolulate; flowers ¾ to 1¼ inches broad; petals 5 to 8, round-obovate to broadly oblong, deep rich glistening yellow; achenes margined.—Swamps and ditches: North Coast Ranges, mostly near the coast. North to Washington. Mar.-May.

Locs.—Berkeley, *Greene;* Millwood, Marin Co., *Eastwood;* Pt. Reyes, *Davy* 6723; Calistoga, *Jepson* 9176; Mendocino Co. (Sherwood Valley, *Davy* 5122, Rowe's Sta., *Chandler* 1054, Round Valley, *Westerman*); Humboldt Co. (Arcata, *Chandler* 1110, Pilot Creek, *Chesnut & Drew,* Elk River Valley, *Tracy* 2574).

Refs.—Ranunculus orthorhynchus Hook. Fl. Bor. Am. 1:21, t. 9 (1829), type loc. Northwest America, *Douglas.* Var. hallii Jepson. Var. platyphyllus Gray, Proc. Am. Acad. 21:377 (1886), based on spms. from the Great Basin region to the Pacific Coast; K. Brandegee, Zoe 4:83 (1893). *R. platyphyllus* Nelson, Bot. Gaz. 42:52 (1906); Piper, Contrib. U. S. Nat. Herb. 11:276 (1906). *R. macranthus* Brew. & Wats. Bot. Cal. 1:8 (1876), not Scheele. *R. maximus* Greene, Bull. Torr. Club, 14:118 (1887), based on San Francisco Bay region spms.

18. **R. marmorarius** Jepson & Tracy n. sp. Stems ascending, 6 to 10 inches high, from perennial roots; herbage sparsely hirsute; basal leaves 3-foliolate, the leaflets cuneate-obovate, 3-cleft into narrow lobes, otherwise entire; cauline leaves deeply 3-parted, or 3 foliolate with lanceolate entire petiolulate leaflets, or simple and lanceolate; achenes with very slender beak as long as or longer than the body.—(Perennis; caules ascendentes, 6-10 poll. alti, sparse hirsuti; folia basalia 3-foliolata; foliola cuneato-obovata, 3-fida, lobis angustis, alioqui integris;

folia caulina profunde 3-fid, vel 3-foliolata foliolatis lanceolatis integris, vel simplex et lanceolata; carpella tenuissima, rostris aequalibus vel longioribus.)

Marble Mt., western Siskiyou Co., *Chandler* (type).

19. **R. hebecarpus** H. & A. Slender delicate annual herb, 5 to 12 inches high, branching, sparsely villous; leaves thin, round or reniform in outline, 3-parted or -divided, the divisions somewhat divergent, entire, notched or lobed, or the uppermost divided into 3 narrowly oblong acute segments; peduncles 3 to 9 lines long; flowers minute, pale yellow; petals early deciduous, commonly before the stamens; achenes few, hispidulous with hooked hairs, orbicular, flat, 1 line long, tipped with a short curved beak.

Common in the foothills and sometimes in the valleys, in the shade of oak and other trees: frequent in the Coast Ranges; Sacramento Valley; Sierra Nevada; Southern California near the coast. South into Lower California, north to Washington.

Locs.—San Diego, *W. S. Wright* 136; Santa Catalina Isl. (Zoe, 1:131); Garvanza, Los Angeles Co., *Greata;* Ft. Tejon, *Davy* 2338; Los Gatos, *Heller* 7302; Ross Valley, Marin Co., *Jepson;* Araquipa Hills, Solano Co., *Jepson;* Scotts Valley, Lake Co., *Tracy* 1703; Capay, Yolo Co., *Blankinship;* College City, *Alice King;* Yreka, *Butler;* Modoc Co., *R. M. Austin;* Auburn, *Bolander* 4510; Angels Camp, *Davy* 1475.

Refs.—Ranunculus hebecarpus H. & A. Bot. Beech. 316 (1840), type from California, *Douglas;* Jepson, Fl. W. Mid. Cal. 201 (1901). Var. *pusillus* Brew. Bot. Cal. 1:9 (1876), 2:426 (1880), a depauperate form.

20. **R. muricatus** L. Annual; stems stout, 3 to 10 inches high; herbage yellowish green, somewhat succulent, glabrous; leaves roundish or reniform, $\frac{3}{4}$ to 2 inches broad, coarsely toothed and commonly 3-cleft; flowers 3 to 7 lines broad; petals 5 (or 3); achenes 4 lines long, including the stout ensiform beak, the sides very flat, surrounded by a conspicuous raised smooth border and coarsely muricate or prickly.

Low places in valley fields: naturalized from Europe, widely scattered in central and northern California, but not common.

Locs.—Eureka, *Tracy* 3185; Hamilton City, *Hall;* Sonoma Valley, *Jepson* 4189; Angel Isl., *Davy* 6906; San Francisco, *Jepson;* Donner Cañon, Mt. Diablo, *Jepson* 7593; Milpitas, *R. J. Smith;* Saratoga (Zoe, 2:128); Knights Ferry, *F. W. Bancroft;* Quartz, Tuolumne Co., *A. L. Grant;* New York Ravine, El Dorado Co., *K. Brandegee.*

Refs.—Ranunculus muricatus L. Sp. Pl. 555 (1753), type European; Jepson, Fl. W. Mid. Cal. 201 (1901).

21. **R. arvensis** L. Hunger-weed. Erect annual, 1 to $1\frac{1}{2}$ feet high; lower leaves with three broad coarsely crenate lobes, the upper 2 or 3 times divided into narrow acute segments; achenes spiny-tuberculate on the raised margin as well as on the sides.

Introduced from Europe. Mariposa Co.

Loc.—Mt. Bullion, *S. J. Johns,* in 1915; seed sent from Potter Valley in 1919 through P. B. Kennedy.

Ref.—Ranunculus arvensis L. Sp. Pl. 555 (1753), type European.

22. **R. andersonii** Gray. Perennial with the scapes and leaves from a stoutish rootstock; herbage glabrous; scapes naked, 4 to 9 inches high, 1-flowered; leaves of rounded outline, palmately twice or thrice dissected into oblong or linear segments; segments acute, 2 to 4 lines long; flowers 12 to 14 lines broad; sepals and petals withering-persistent; sepals round-ovate, purplish-margined; petals rose color or pink, roundish, with short narrow claw and a pocket like pit near the base of the blade; achenes numerous, strongly utricular, 3 to 4 lines long, the beak very short.

Great Basin region from Oregon to Arizona, entering California in Modoc and Mono cos.

Locs.—Jess Valley, Modoc Co., *L. S. Smith.* Jupiter Mt., Malheur Co., Ore., *Cusick* 2371;

Gold Mt., Nev., *Purpus* 5991; Karshaw, Meadow Valley Wash, Nev., *Gooding* 630; Virgin Mts., Ariz., *Gooding* 2135.

Refs.—RANUNCULUS ANDERSONII Gray, Proc. Am. Acad. 7:327 (1868), type loc. Blind Springs Mt., Mono Co., *Anderson*. *Oxygraphis andersonii* Freyn, Flora 70:140 (1887). *Beckwithia austinae* Jepson, Erythea, 6:97 (1898). *B. andersonii* Jepson, l.c. 99.

RANUNCULUS JUNIPERINUS Jones is a closely related Utah species, differing from R. andersonii in its whitish petals and non-inflated achenes.

23. **R. cymbalaria** Pursh. DESERT CROWFOOT. Perennial by whip-like or thread-like stolons which root at intervals of 1½ to 2½ inches and produce tufts of leaves and scapes; scapes 1¼ to 8 inches high, 1 to 3-flowered; leaves round-ovate to reniform, cordate at base, remotely notched, 4 to 10 lines long; flowers 4 to 6 lines broad; petals 5 to 9 (or 12), oblong, shorter than or little exceeding the sepals; receptacle oblong-conic, obtuse, 2 to 6 lines high; achenes with striate sides.

Moist alkaline soils in river bottoms or desert lake beds or about desert springs: Southern California to the Mohave Desert and the upper San Joaquin Valley, and north along the eastern side of the Sierra Nevada through Inyo and Lassen cos. to Modoc Co. Widely distributed in North and South America and Asia. May-July.

Locs.—Los Angeles River, *Braunton* 564; Swarthout Cañon, *Hall* 1526; San Bernardino, *Parish;* Barstow, *Jepson* 4796; Bakersfield, *Davy* 1699; Fresno, *Eisen;* Templeton Mt., *Jepson* 4974 (dwarf form); Owens Lake, *Jepson* 5114; White Mts., *Jepson* 7228 (Silver Cañon), 7272 (North Fork Crooked Creek); Beckwith Pass, *Jepson* 7768; Honey Lake Valley, *Davy* 3370; Alturas, *Jepson* 7928; Ft. Bidwell, *Manning* 141.

Refs.—RANUNCULUS CYMBALARIA Pursh, Fl. 392 (1814), type loc. Onondaga, New York; Merritt, Erythea, 4:102 (1896). *Halerpestes cymbalaria* Greene, Pitt. 4:208 (1900). The representation of this species in the Rocky Mt. and Pacific Coast region is set aside by Fernald as var. *saximontanus* (Rhod. 16:162,—1914), but our California material seems seditious towards the proposed segregation.

24. **R. aquatilis** L. WATER BUTTERCUP. Perennial submersed aquatic, only the tips of the slender stems and the flowers resting on the surface of the water; leaves all many times dissected into filiform or capillary divisions, rarely some floating leaves with 3 broad lobes 2 or 3-toothed at apex; flowers 3 to 5 (or 8) lines broad; sepals deciduous; styles subulate, rarely persisting; receptacle often hairy; achenes transversely rugose, commonly hispidulous, about 11 to 18 in a rather compact round head.

Ponds, vernal pools, and slow streams in the valleys and mountains: Coast Ranges; Sierra Nevada; Southern California. It is variable, and being rather common and nearly cosmopolitan, a large number of forms have received specific names. Apr.

Locs.—Coast Ranges: Sisson, *Jepson;* Calistoga, *Jepson;* Oak Knoll, Napa Valley, *Jepson;* Berkeley, *Jepson;* Milpitas, *R. J. Smith.* Sierra Nevada: Modoc Co., *M. S. Baker;* Clover Creek, Genesee Valley, *Jepson* 8023; Bear Valley, Nevada Co., *Jepson;* Hope Valley, North Fork Carson River, *Jepson* 8125; Phoenix Lake, Sonora, *A. L. Grant;* Sequoia (Crockers), *Jepson* 4639; Fish Camp, Mariposa Co., *Jepson* 8395; Volcano Creek, *Jepson* 953. Southern California: Cedar Cañon, San Diego Co., *Forbes.*

Var. **trichophyllus** Gray. GREEN EEL GRASS. Leaves rather short and rigid, not collapsing on withdrawal from the water.—Widely distributed. Var. **bakeri** Jepson n. comb. Leaves small, sparsely branched, the rigid segments divaricate.—Santa Clara Co. Var. **peduncularis** Jepson n. comb. Peduncles very stout, falcate-curved, 1 inch long (ex. char.).—Lake Co. Var. **hispidulus** Drew. Lower base of the emersed leaves, and the petioles and stipules hispid.—Humboldt Co.

Refs.—RANUNCULUS AQUATILIS L. Sp. Pl. 556 (1753), type European; Jepson, Fl. W. Mid. Cal. 202 (1901). *Batrachium aquatile* Wimm. Fl. Schles. 8 (1841). Var. TRICHOPHYLLUS Gray, Man. ed. 5, 40 (1867). Var. BAKERI Jepson. *Batrachium bakeri* Greene, Leaflets, 1:95 (1904), type loc. Coast Range hills near Stanford, *C. F. Baker* 786. Var. PEDUNCULARIS Jepson. *Batrachium pedunculare* Greene, l.c., type loc. Lakeport, *C. F. Baker* 3062. Var. HISPSIDULUS Drew, Bull. Torr. Club, 16:150 (1889), type loc. Jarnigan's, Mad River, *Drew.*

25. **R. lobbii** Gray. Lobb's Buttercup. Annual; submersed leaves none, or when present, few and as in R. aquatilis; floating leaves 6 to 9 lines broad, divergently 3-parted into oblong or ovate lobes, the lateral lobes notched and the middle one commonly entire, or, rarely, all notched; stamens 5 to 10; petals withering persistent; style filiform, about 3 times the length of the ovary; achenes few (4 to 6), rugose, the mature ones commonly with minute black dots.

Whitening the surface of shallow vernal pools: Alameda and Marin cos. to Napa Valley and northern Sonoma. North to British Columbia.

Locs.—Berkeley Hills, *Chandler* 787; betw. Alpine Lake and Fairfax, *Newlon* 97a; Cazadero, *Davy* 1659; Healdsburg, *Alice King;* Calistoga, *Jepson;* St. Helena, *C. F. Baker* 1997.

Refs.—RANUNCULUS LOBBII Gray, Proc. Am. Acad. 21:364 (1886); Jepson, Fl. W. Mid. Cal. 202 (1901). *R. hydrocharis* f. *lobbii* Hiern. Jour. Bot. 9:66, pl. 114 (1871), type from Oregon, *Lobb.* *R. hederaceus* var. Brew. & Wats. Bot. Cal. 1:5 (1876).

14. **KUMLIENIA** Greene.

Glabrous perennial with the leaves and 1-flowered scapes from a fascicle of thickened or fleshy-fibrous roots. Leaves all basal, roundish, shallowly 3-lobed and sparingly toothed, cordate or truncate at base. Sepals 5 or 6, white. Petals 5 or 6, minute, reduced to small yellow stiped nectaries. Achenes sub-follicular, capitate, membranous, lanceolate, attenuate upward into a broadly subulate beak hooked or coiled at the tip, 2 (or 3) -nerved on the sides, at least when dead ripe. Seed fusiform, longitudinally multi-striate.—Species 2, North America. (T. L. Kumlien, one-time Professor of Natural History at Albion College.)

1. **K. hystricula** Greene. Scapes 2 to 9 inches high; leaves roundish in outline but broader than long, ½ to 2½ inches broad, on petioles ¾ to 2 inches long; flowers 5 to 7 (or 12) lines broad; sepals oval; nectaries spoon-shaped, one line long; achenes weakly pubescent, 2 to 2½ lines long; seed ¾ line long.

Clefts of rocks on moist cañon sides, often within reach of flying spray: Sierra Nevada at middle altitudes (1500 to 5000 feet). North to Oregon. Mar.-June.

Tax. Note.—The flowers as seen in their native habitat are delicately engaging and somewhat suggestive of those of Anemone quinquefolia. While individuals are not uncommon in favored spots, specimens are rare in herbaria. Quite dead ripe fruit is seldom collected. Some very mature material from El Dorado Co. is available to us and on examining it we find that the carpels in extreme age split roughly but spontaneously from the base upward along the ventral and dorsal lines into two equal valves, thus releasing the single seed. Were these carpels not capitate, they would, it seems certain, be termed follicles. Our species may belong to the genus Oxygraphis Bunge, but the type of that genus is known to us only from somewhat insufficient descriptions.

Locs.—Bear Creek Cañon, Tulare Co., *Purpus* 1756; Yosemite Falls, *Jepson* 4261; Hetch-Hetchy, *A. L. Grant* 1268; Columbia, *A. L. Grant;* Italian Bar, Stanislaus River, *Jepson* 6369; Dardanelles Cañon, Placer Co., *Bolander* 4630; North Fork American River, *K. Brandegee;* Butte Co., *Austin & Bruce.*

Refs.—KUMLIENIA HYSTRICULA Greene, Bull. Cal. Acad. 1:337 (1886); Pitt. 3:188, pl. 2 (1897). *Ranunculus hystriculus* Gray, Proc. Am. Acad. 7:328 (1868), type spms. from Forest Hill and Newcastle, Placer Co., *Bolander.*

15. **CLEMATIS** L. VIRGIN'S BOWER.

Stems woody below, climbing by aid of the petioles of the opposite compound leaves. Peduncles axillary, bearing 1 to numerous flowers. Flowers (in ours) polygamous. Sepals 4, valvate in the bud, white and petal-like. Petals none (in ours). Stamens numerous. Achenes numerous in a head-like cluster, the styles persistent as hairy or plumose tails, very conspicuous in fruit.—Species about 170, all continents. (Ancient name, from Greek klema, a twig.)

Peduncle bearing a cymose panicle of many flowers, the cymes leafy-bracteate; leaflets 5 to 7;
  achenes pubescent .... 1. *C. ligusticifolia.*

Peduncle 1 to 3-flowered, with 2 bractlets below the middle.
  Leaflets 3; achenes pubescent .... 2. *C. lasiantha.*
  Leaflets mostly 5 to 9; achenes glabrous .... 3. *C. pauciflora.*

1. **C. ligusticifolia** Nutt. Yerba de Chivato. Nearly glabrous, except the inflorescence; leaflets 5 to 7, ovate, cordate or obtuse at base, 3-lobed or coarsely toothed about midway, or nearly entire, mostly 1 to 3 inches long; peduncles 1 to 4 inches long, bearing a panicle of many to numerous flowers; flowers ½ to ¾ inch in diameter; sepals narrowly oblong, acute, tomentulose; tails of the achenes 10 to 13 lines long; fruiting panicles corymbose to long-paniculate, 2 to 15 inches long.

Valleys, foothills and mountains: Coast Ranges; Sierra Nevada; Southern California.

Biol. and Economic Note.—It climbs high over shrubs and sometimes ascends trees. In Mill Creek Cañon, San Bernardino Mts., we found the vines festooning alders (Alnus rhombifolia Nutt.) to a height of 50 feet; their trunk "cables" or stringers measured 4 to 12 inches in circumference. An infusion of the herbage is used by Spanish-Californians as a healing wash for barbwire cuts in horses.

Locs.—Coast Ranges: Yreka, *Butler* 1810; Sisson, *Jepson;* Salmon River Forks, *Jepson;* Ukiah, *Purdy;* Vaca Mts., *Jepson;* Green Valley, *Jepson;* Napa Valley, *Jepson* (sepals sometimes 5); Mark West Creek, *Bioletti;* Santa Cruz, *F. P. McLean;* Carmel River, *Jepson;* Cantua Creek, San Carlos Range, *Lillis;* Santa Barbara, *M. S. Baker.* Sierra Nevada: Amador Co., *Hansen;* Hetch Hetchy, *Jepson* 3426; Erskine Creek, *Purpus* 5627. Desert ranges: Silver Cañon, White Mts., *Jepson* 7411; Hanaupah Cañon, Panamint Mts., *Jepson* 6966. Southern California: Mint Cañon, San Gabriel Mts., *Peirson* 264; Claremont, *C. F. Baker* 3458; San Antonio Cañon, *Peirson* 52; San Bernardino Valley, *Parish;* Mt. San Jacinto, *Hall.* Also on Santa Rosa, Santa Cruz, and Santa Catalina islands (Zoe, 1:131).

Refs.—Clematis ligusticifolia Nutt.; T. & G. Fl. 1:9 (1838), type from "plains of the Rocky Mts.," *Nuttall;* Jepson, Fl. W. Mid. Cal. 198 (1901). Var. *californica* Wats. Bot. Cal. 1:3 (1876).

2. **C. lasiantha** Nutt. Pipe-Stem. Branchlets and sepals tomentose-pubescent, the foliage less so; leaves trifoliolate, the leaflets elliptic to orbicular, truncate or rounded at base, coarsely toothed and often 3-lobed, 1 to 2 inches long; peduncles 1 (rarely 3) -flowered, 2 to 6 inches long; flowers 1¼ to 2¼ inches in diameter; sepals broadly oblong, usually obtuse; achenes supporting a tail 1 to 1½ inches long; the fruit of one flower forming a head-like cluster 2 to 2½ inches broad.

Cañons of the Coast Ranges, Sierra Nevada, and mountains of Southern California: clambering over shrubs or low trees and often illuminating a hillside with its profusion of flowers. Occasionally along streams in the valleys. Apr.-May.

Locs.—Coast Ranges: New River, Trinity Co., *Jepson;* St. Helena, *Jepson;* Vaca Mts., *Jepson;* Ross Valley, *Bioletti;* Oakland, *Chesnut;* Los Gatos, *Heller* 7269; Santa Lucia Creek above Arroyo Seco, *Jepson;* San Luis Obispo, *Summers.* Sierra Nevada: Butte Co., *R. M. Austin;* Gwin Mine, Calaveras Co., *Jepson;* Rawhide, Tuolumne Co., *A. L. Grant* 660; Middle Fork Kaweah River, *Jepson.* Southern California: Millards Cañon, San Gabriel Mts., *Peirson* 51; Mill Creek, San Bernardino Mts., *Parish;* Cuyamaca, *Hall.*

Refs.—Clematis lasiantha Nutt.; T. & G. Fl. 1:9 (1838), type loc. San Diego, *Nuttall;* Torr. Bot. Mex. Bound. 29, pl. 1 (1859); Jepson, Fl. W. Mid. Cal. 197 (1901).

3. **C. pauciflora** Nutt. Rope Vine. Stems slender; herbage silky-pubescent when young; leaves more or less fascicled, 3 to 5-foliolate or the basal leaflets each replaced by 3 leaflets; leaflets roundish to ovate, toothed and often 3-lobed, often cordate at base, ¼ to 1 inch long; peduncles 1 (or 3)-flowered, ¾ to 1 inch long; flowers ¾ to 1 inch broad; sepals 4 or 3; achenes glabrous, their tails about 1 inch long.

Trailing over rocks or clambering over bushes: cismontane Southern California. Mar.-Apr.

Locs.—San Bernardino, *Parish* 3626; Santa Ana, *Alice King;* San Jacinto, *Gregory;* Winchester, *M. M. Todd;* Menifee, *Alice King;* Carrizo Creek, *T. Brandegee;* San Diego, *Abrams* 3428.

Refs.—Clematis pauciflora Nutt.; (by error *parviflora*) T. & G. Fl. 1:9 (1838), type loc. San Diego, *Nuttall;* Gray, Syn. Fl. 1^1:5 (1895).

CALYCANTHACEAE. Sweet-shrub Family.

Aromatic shrubs with opposite entire leaves and no stipules. Flowers large, solitary, terminating the branches. Bracts, sepals and petals passing into each other, imbricated in many series, adnate at base to the enlarged hollow receptacle which is like a rose-cup. Stamens numerous, the inner ones sterile. Pistils many, distinct, nearly enclosed in the hollow receptacle, becoming achenes.—Monotypic genus of 6 species, 4 in North America and 2 in Asia.

Bibliog.—Kearney, T. H., Nomenclature of the genus Buettneria Duham. (Bull. Torr. Club 21:173–175,—1894).

1. CALYCANTHUS L.

Flowers livid red. Petals in several rows at mouth of tube, the inner ones shorter. Styles equaling the anthers, filiform, colorless. Seed without endosperm; cotyledons foliaceous, convolute, caulicle inferior. (Greek kalyx, covering or calyx, and anthos, flower.)

1. **C. occidentalis** H. & A. Spice Bush. Sweet Shrub. (Fig. 109.) Erect branching shrub 5 to 9 feet high; leaves ovate to oblong-lanceolate, acute, rounded at base, 1½ to 6 inches long; sepals and petals linear-spatulate, 1¼ inches long or less, the upper ½ or ⅓ fading tawny or brown in age; filaments ⅓ line long; fruiting receptacle cup-like, 1 to 1¼ inches long; achenes oblong-ovate, slightly oblique or curved, a trifle flattened and bordered all around with a granular margin, somewhat velvety-hirsute, 4 to 5 lines long.

Along cañon streams in the North Coast Ranges and Sierra Nevada foothills.

Folk Lore.—This shrub has always interested the settlers in the foothills and it has acquired in consequence a variety of common names. It is called "Spice-wood" on Howell Mt., "Wine Flower" in Sonoma Co., "Spice Bush" in Napa Valley, "Wild Poppy" in Trinity Co., where it is reputed poisonous to cattle, and "Vinegar Bush" in the Kaweah region. A crushed flower is sometimes put in a knotted corner of the handkerchief by the hill folk as a perfume.

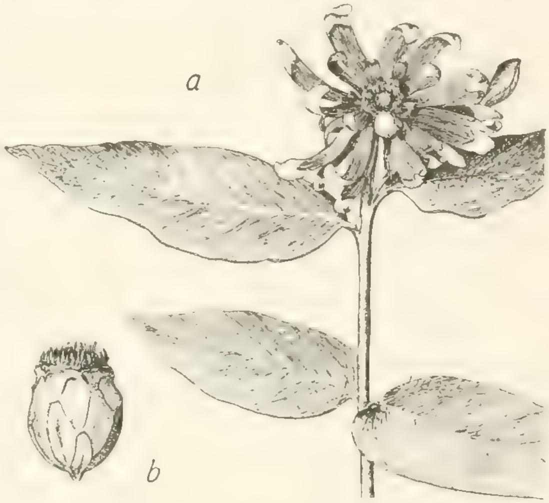

Fig. 109. Calycanthus occidentalis H. & A. *a*, flowering branchlet; *b*, fruiting receptacle. × ½.

Locs.—Coast Ranges: Peanut, Trinity Co., *J. W. Patton;* Cloverdale, *Bolander;* Mark West Creek, *Jepson;* Mt. St. Helena, *Jepson;* sw. of Calistoga, *Jepson;* Howell Mt., *Jepson* 1725; Gates Cañon, Vaca Mts., *Jepson* 561; Cazadero, *Blasdale;* Sonoma, *Bioletti.* Sierra Nevada: Morley Sta., Shasta Co., *M. S. Baker;* Table Mt., n. of Oroville, *Heller* 10,782; Merced River near Grouse Creek, *Jepson* 8354; Cedar Creek, Sequoia Park, *Jepson;* South Fork Kaweah River, *Jepson.*

Refs.—Calycanthus occidentalis H. & A. Bot. Beech. 340, t. 84 (1840); Jepson, Fl. W. Mid. Cal. 190 (1901). *Butneria occidentalis* Greene, Erythea 1:207 (1893).

BERBERIDACEAE. Barberry Family.

Shrubs or herbs, ours with alternate compound leaves. Flowers perfect, regular, hypogynous. Sepals 6, in 2 circles. Petals 6, in 2 circles, the stamens as many and opposite them. Anthers opening by an uplifting valve or lid. Ovary one, superior, 1-celled, becoming in fruit a capsule, a berry, or dry and coriaceous. Seeds with endosperm. Achlys is anomalous: it has no perianth and 9 to 13 stamens.—Genera 8 and species about 140, mostly north temperate zone, only Berberis reaching into the southern hemisphere.

Bibliog.—Lindley, J., Evergreen Barberries cult. in Great Britain (Jour. Lond. Hort. Soc. 5:1–21,—1850). Fedde, F., Versuch einer Monographie der Gatt. Mahonia (Engler, Jahrb. 31:30–133, figs. 1–5,—1901).

Shrubs or low woody plants; leaves pinnate, prickly; petals bifid ....1. BERBERIS.
Perennial herbs; leaves all basal, ternate, not prickly.
  Calyx and corolla none; leaves with 3 sessile leaflets ....2. ACHLYS.
  Calyx and corolla present, reflexed; petals entire; petioles once or twice ternately divided, the divisions bearing 3 (rarely 1) petiolulate leaflets ....3. VANCOUVERIA.

1. BERBERIS L. BARBERRY.

Evergreen shrubs or low suffrutescent plants with yellow wood. Leaves alternate, prickly, in ours pinnately compound with the rachis jointed at the insertion of the leaflets. Flowers yellow, in racemes. Sepals petal-like. Petals concave, in ours distinctly bifid. Filaments irritable. Stigma peltate-umbilicate. Fruit a berry. Species about 110, all continents except Australia. (Arabic name.)

Filaments with a pair of recurved teeth near the apex; racemes short, from small terminal or lateral buds; bud-scales few, deciduous, small (1 to 2 lines long); leaflets 3 to 9, pinnately veined.
  Leaflets with comparatively few (mostly 5 to 15) teeth, the teeth strongly spinose; erect shrubs of dry inner ridges or of the desert.
    Racemes loosely few-flowered.
      Leaflets equal or nearly so; tooth-like lobes of the leaflets coarse, mostly subequal ....1. *B. fremontii.*
      Terminal leaflet much longer than the lateral ones; terminal lanceolate tooth of each leaflet often entire, many times larger than the small lateral teeth 2. *B. nevinii.*
    Racemes densely many-flowered; teeth of the leaflets very coarse ......3. *B. californicum.*
  Leaflets with more numerous teeth.
    Foliage not very dense; leaflets with many teeth.
      Low (about ½ to 1 foot high).
        Stems erect or ascending; leaflets mostly pale or glaucescent above, mostly glaucous or whitish beneath, their teeth spine-tipped ....4. *B. pumila.*
        Stems prostrate or ascending; leaflets dull, their teeth bristle-tipped..5. *B. repens.*
      Erect, 1 to 3 feet high; leaflets shining above, their teeth spine-tipped ....6. *B. aquifolium.*
    Foliage mostly forming a dense terminal fascicle; leaflets thin, with numerous small bristle-tipped teeth; coast region ....7. *B. pinnata.*
Filaments without teeth; racemes elongated, loose, solitary or few from a terminal bud; bud-scales large (¾ to 1¾ inches long), persistent; leaflets 11 to 21, somewhat palmately veined ....8. *B. nervosa.*

1. **B. fremontii** Torr. DESERT BARBERRY. Shrub 5 to 8 (or 15) feet high; leaflets 5, ovate, rigidly coriaceous, yellowish or glaucous, scarcely at all or only moderately undulate, 6 to 12 lines long, strongly and sinuately 5 or 7-lobed, the lobes strongly spinose; petiole articulated near the base or often a supplementary pair of leaflets borne at this point; racemes few (3 to 9)-flowered, 1 to 1¼ inches long, the peduncles as long or almost none; berries at maturity dull brown, somewhat inflated, 5 to 6 lines in diameter.

Mountain slopes: eastern Mohave Desert; Colorado Desert. East into Arizona and southern Nevada, south into Lower California and Sonora. May–June.

Locs.—New York Mts., *Jepson* 5438; Jacumba, *Abrams* 3693.

Refs.—BERBERIS FREMONTII Torr. Bot. Mex. Bound. 30 (1859), type loc. Virgen River, s. Utah, *Fremont*. *Mahonia fremontii* Fedde in Engler Jahrb. 31:98 (1901). *Odostemon fremontii* Rydb. Bull. Torr. Club 33:141 (1906).

2. **B. nevinii** Gray. Shrub 6 to 8 feet high, with many erect loose branches; leaflets 5, ½ to 1¼ inches long, the lateral oblong, the terminal one broadly lanceolate, acuminate, all with few and small spinose teeth; petioles almost none; racemes loosely 5 to 7-flowered.

Sandy slopes, eastern edge of San Fernando Valley; very closely allied to B. fremontii.

Refs.—BERBERIS NEVINII Gray, Syn. Fl. 1^1:69 (1895), type loc. San Fernando Valley, *Nevin*. *Mahonia nevinii* Fedde in Engler Jahrb. 31:102 (1901). *Odostemon nevinii* Abrams, Bull. N. Y. Bot. Gard. 6:359 (1910).

3. **B. californicum** Jepson n. sp. Stems rigidly erect, 3 to 6 (or 10) feet high, little branched; leaves 1½ to 4 inches long; leaflets 5 to 9, ovate, 1 to 2 inches long, very pale or glaucescent, strongly reticulate, repandly dentate, the 8 to 12 teeth ending in long stout spines, their length ⅓ to ⅔ the breadth of the body of the blade, the blade so strongly undulate that the spines are presented in nearly all directions; racemes 1 to 2 inches long, the pedicels mostly 3 to 5 lines long.—(Caules erecti, rigidi, 3–6 (vel 10) ped. alti; folia 1½–4 poll. longa, 5–9-foliolata; foliola ovata, 1–2 poll. longa, sub-glauca, per-reticulata, per-undulata, dentibus spinosis; racemi 1–2 poll. longi.)

Dry rocky interior foothills, 300 to 1500 feet or up to 6000 feet on desert ridges: Inner Coast Range, southward to cismontane Southern California; apparently also in southern Sierra Nevada foothills.

Locs.—Pellejo Hills, nw. Solano Co., *Jepson* (type); North Fork Lewis Creek, Priest Valley, *Jepson* 2672; near San Carlos Peak, *Brewer* 787; Rancho Cantua, Cantua Creek, *S. C. Lillis;* East Fork Kaweah River, *Jepson;* Loma Paloma, *Hall* 7083 (spines of leaflets less prominent); Eaton Cañon, San Gabriel Mts., *Peirson* 54; Sheep Creek, San Antonio Mts., *Hall;* Seven Oaks, San Bernardino Mts., *Geo. B. Grant* 4066; Bloomington, San Bernardino Valley, *Parish* 4086; betw. Julian and Cuyamaca (Bull. N. Y. Bot. Gard. 6:360).

Refs.—BERBERIS CALIFORNICUM Jepson. *Odostemon dictyota* Abrams, Bull, N. Y. Bot. Gard. 6:360 (1910). Probably also *Odostemon fascicularis* Abrams, l.c.

4. **B. pumila** Greene. Stems erect, rigid, 5 to 14 inches high; leaflets 5 (3 to 7), broadly ovate, whitish, glaucescent or dull green, 1¼ to 2¼ inches long, the rather coarse or medium-sized teeth about 10 to 18, spine-tipped; racemes dense, 1 to 1½ inches long; berries blue, small, oblong.

Inner North Coast Range and higher Sierra Nevada foothills; north to southern Oregon; 3000 to 5000 feet.

Locs.—Bartlett Mt., Lake Co., *Curran;* Indian Creek, Siskiyou Mts., *Jepson* 2948; Clover Creek, Shasta Co., *M. S. Baker* 464; Downieville, *Eastwood;* Mt. Zion, Amador Co., *Hansen* 219; Five-mile Creek, Columbia, *A. L. Grant* 634; Belmont Mine, Mariposa Co., *Congdon;* Old Colony Mill, Sequoia Park, *Jepson* 628.

Refs.—BERBERIS PUMILA Greene, Pitt. 2:161 (1891), type loc. inner North Coast Range in Lake Co., as near as may be determined. *Mahonia pumila* Fedde in Engler Jahrb. 31:82 (1901).

5. **B. repens** Lindl. CREEPING BARBERRY. Stems ascending from a creeping or stolon-like base, simple, 4 to 6 inches high; leaflets 3 to 5, plane or nearly so, dull above, paler beneath, with many small teeth and weak spines; racemes rather dense, 2 to 2½ inches long; berries blue-glaucous.

Del Norte Co. to Modoc Co., thence south to Inyo Co. North to British Columbia and east to the Rocky Mts.

Locs.—Big Flat, Del Norte Co., *Jepson* 2985; Mt. Eddy, *Copeland* 3810; Edgewood, Siskiyou Co., *J. W. Kisling;* Davis Creek, Modoc Co., *M. S. Baker;* Willow Creek Valley, Modoc Co., *R. M. Austin;* Oak Creek, Inyo Co., *S. W. Austin.*

Refs.—BERBERIS REPENS Lindl. Bot. Reg. pl. 1176 (1828), type from Northwest America. *Odostemon repens* Cockerell Univ. Mo. Stud. Sci. 2^2:125 (1911). *Mahonia repens* G. Don, Dichlam. 118 (1831).

6. **B. aquifolium** Pursh. MOUNTAIN GRAPE. Stems erect, 1 to 3 feet high; leaves thin-coriaceous, bright-green and glossy-shining above, duller beneath; leaflets plane, 3 to 5 or 7, elliptic-ovate to oblong-ovate, 1¼ to 3 inches long, the margin with many long slender spines; lowest pair of leaflets remote from base of petiole; racemes fascicled in the axils and at the summit, dense, 1 to 2 inches long; berries blue, glaucous, rather large.

North Coast Ranges, from Napa Co. to Humboldt Co.; northern Sierra Nevada from Amador Co. to Modoc Co. North to British Columbia. Also called Hollyleaf Barberry.

Locs.—Near Mt. St. Helena, *Jepson;* Hupa, *Chandler* 1277; Edgewood, *J. W. Kisling;* Yreka, *Butler* 591; Lassen Creek, Modoc Co., *R. M. Austin;* Truckee, *Sonne;* Amador Co., *Gates.*

Var. **dictyota** Jepson n. comb. Erect, stout, ½ to 1 foot high, sparsely leafy; leaflets 5 to 7, broadly ovate, prominently reticulated, shining and yellow above, paler beneath, 1 to 2¼ inches long, undulate, sinuous-dentate, the 10 to 20 teeth with strong spines; lowest pair close to base of petiole; racemes dense, ¾ to 1 inch long.—Rocky slopes, Marysville Buttes.

Refs.—Berberis aquifolium Pursh, Fl. 1:219 t. 4, in part (1814), type loc. great rapids of the Columbia River, *Lewis;* Lindl. Bot. Reg. t. 1425 (1831). *Mahonia aquifolium* Nutt. Gen. 1:212 (1818). Var. dictyota Jepson. *B. dictyota* Jepson Bull. Torr. Club, 18:319 (1891), type loc. South Peak, Marysville Buttes, *Jepson;* Fl. W. Mid. Cal. 203 (1901). *Mahonia dictyota* Fedde in Engler, Bot. Jahrb. 31:89 (1901).

7. **B. pinnata** Lag. California Barberry. Stems erect, stout, branching, ¼ to 1½ feet high (or even to 4 or 5 feet); leaves 2 to 4 inches long; leaflets usually 7 to 13, but sometimes 5 to 17, rather crowded on the rachis, ovate-elliptical to oblong, thinnish and plane, somewhat bubbly-undulate, 1 to 2¼ inches long, shining above, somewhat paler beneath, shallowly sinuate-dentate, the numerous teeth prickly; lowest pair close to base of petiole; racemes clustered, dense.

Hill summits and slopes, mostly along the edge of thickets, Marin Co. to Monterey. Mar.-Apr.

Locs.—Marin Co., *Eastwood;* Berkeley Hills, *Jepson;* Lake Merced, San Francisco, *Jepson;* Colma Cañon, San Mateo Co., *Ehlers.*

Refs.—Berberis pinnata Lag. Elench. Hort. Madr. 6 (1803), type loc. Monterey, Cal.; Jepson, Fl. W. Mid. Cal. 204 (1901). *Mahonia pinnata* Fedde in Engler, Jahrb. 31:86 (1901).

8. **B. nervosa** Pursh. Oregon Grape. Stem scaly, caudex-like, simple, ½ to 1 (or 2) feet high, bearing the leaves in a terminal tuft; leaves 9 to 16 inches long, the rachis conspicuously nodose; leaflets 11 to 21, bright green, ovate to ovate-lanceolate, spinulose-serrate, and somewhat palmately nerved, 1½ to 3 inches long; scales of the strong terminal bud ¾ to 1¾ inches long, coriaceous-glumaceous; racemes erect, elongated, 2 to 4 (or 6) inches long; bracts oblong to lanceolate, membranaceous; berries blue-glaucous, 4 to 5 lines in diameter.

Woods near the coast from the Santa Lucia Mts. to Shasta and Siskiyou cos. Northward to British Columbia.

Locs.—Lucia to Mill Creek, *Jepson;* Mt. Tamalpais, *Bioletti;* Stewart Pt., *M. S. Baker* 761; Rockport (fruiting racemes 10 in. long), *Jepson;* Jackson Valley, Mendocino Co., *Jepson;* Pepperwood, *Jepson;* Eureka, *Tracy* 2016 (unbranched, 6 ft. high); Redwood Creek, n. Humboldt Co., *Jepson;* Hupa, *Chandler* 1285; Salmon Summit, *Jepson;* Russian Creek, w. Siskiyou, *Butler* 1287½. Vancouver Isl., B. C., *A. J. Pineo.*

Refs.—Berberis nervosa Pursh, Fl. 219, t. 5 (1814), type loc. Cascades, Columbia River, *Lewis;* Jepson, Fl. W. Mid. Cal. 204 (1901). *Mahonia nervosa* Nutt. Gen. 1:212 (1818). *Berberis glumacea* Lindl. Bot. Reg. t. 1426 (1831).

2. **ACHLYS** DC.

Perennial herbs with long-petioled 3-foliolate leaves and leafless scapes rising from a very slender rootstock. Flowers perfect, in a short dense spike. Calyx and corolla none. Stamens 9 to 13, 2 to 3 times as long as ovary, the outer dilated upward. Fruit dry, indehiscent, broadly moon-shaped. Species 2, one in Japan, the other in Pacific North America. (Greek Achlus, the god of night or gloom.)

1. **A. triphylla** DC. Deer-foot. Plants about 1 foot high; leaflets fan-shaped, sinuate-dentate, 2 to 6 inches broad.

Woods near the coast, 100 to 2500 feet, Mendocino Co. and northward. Also called Sweet Leaf. Settlers on the Humboldt coast, prizing the delicate fragrance, hang bunches of the leaves in their houses.

Locs.—Big River headwaters, *Jepson* 8424; Willits, *Jepson* 2408; Cahto to Dehaven, *Jepson;* Redwood Creek, n. Humboldt Co., *Jepson.*

Refs.—Achlys triphylla DC. Syst. 2:35 (1821), type from the Northwest Coast, *Menzies;* Jepson, Fl. W. Mid. Cal. ed. 2, 173 (1911). *Leontice triphylla* Smith, Rees Cycl. 20:5 (1812), type loc. Northwest Coast, *Menzies.*

3. **VANCOUVERIA** Morr. & Dec.

Low perennial herbs with slender creeping rootstocks. Leaves once or twice ternately compound, all basal or nearly so. Flowers small, nodding, arranged in an open panicle on a slender scape-like peduncle. Sepals 6, in 2 series, obovate, petal-like, reflexed, subtended by 6 to 9 small calyx-like membranous bractlets. Petals 6, ligulate, tipped with a hood-like nectar-bearing appendage, reflexed.

Stamens 6, closely erect about the pistil, the anther connective produced into a pointed tip. Style 1; stigma thin, cup-shaped. Fruit a follicle. Seeds with an aril.—Species 3, Pacific North America. (Capt. George Vancouver of the English exploring ship Discovery, who visited San Francisco Bay in 1792.)

Leaflets with cartilaginous margin; panicle beset with gland-tipped hairs; stamens glabrous .... 1. *V. parviflora.*
Leaflets not cartilaginous-margined; panicle glabrous; stamens covered with short gland-tipped hairs .... 2. *V. hexandra.*

1. **V. parviflora** Greene. Inside-out Flower. Stems 8 to 20 inches high, sparsely hairy, at base rusty-pilose, the panicle pubescent with short spreading gland-tipped hairs; leaves glabrous or with rusty hairs on the petioles at the forks, persisting through the winter; leaflets thickish, roundish in outline, broadly cordate at base, with mostly closed sinus, obscurely or evidently 3-lobed with a notch at the summit of each lobe, ¾ to 1½ inches long, frequently broader than long, the margin cartilaginous and often crisped; panicle 2½ to 7 inches long, 25 to 55-flowered; flowers white or lavender-tinged, 4 lines long; sepals 2 lines long; stamens glabrous.

Shade of coniferous forests, mostly in the Redwood region, from the Santa Lucia Mts. to Humboldt Co. May-June 5.

Locs.—Pico Blanco, Monterey Co., *Davy* 7353; Big Basin, Santa Cruz Mts., *Copeland* 3051; Mt. Tamalpais, *Chesnut & Drew;* Redwood Peak; Calistoga, *Jepson;* Noyo River, *Charlotte Hoak;* Cahto, *Jepson* 1867; Grizzly Gulch, Humboldt Co., *Tracy* 2678; Salmon Summit, *Jepson.*

Refs.—Vancouveria parviflora Greene, Pitt. 2:100 (1890), based on plants of the Santa Cruz Mts. and Mt. Tamalpais; Jepson, Fl. W. Mid. Cal. ed. 2, 173 (1911). *V. chrysantha* Greene var. *parviflora* Jepson, Fl. W. Mid. Cal. 204 (1901).

2. **V. hexandra** Morr. & Dec. Flowering stems 7 to 21 inches high; leaves sparingly pubescent with short scattered hairs, perishing after the maturing of the fruit; leaflets thinnish, ovate to oval or roundish in outline (seldom broader than long), ¾ to 1½ inches long, cordate at base with open sinus, 3-lobed at apex (the middle lobe largest); panicle glabrous, 10 to 25-flowered; flowers 6 lines long; sepals 3 lines long; sepals and petals pearly white; stamens covered with small stipitate glands; ovules 3 in each cell.

Woods, 500 to 3000 (or even 4000) feet. Mendocino Co. to Siskiyou Co. and northward to Washington. Commonly in deeper shade than V. parviflora. May-June.

Locs.—Noyo River, *Charlotte Hoak;* Pepperwood, *Jepson* 1912; South Fork Mt., Humboldt Co., *Chesnut & Drew;* Humboldt Bay, *Chandler* 1162; East Fork Illinois River, Siskiyou Mts., *Jepson* 2935.

Refs.—Vancouveria hexandra Morr. & Dec. Ann. Sci. Nat. ser. 2, 2:351 (1834); Jepson, Fl. W. Mid. Cal. ed. 2, 174 (1911). *Epimedium hexandra* Hook. Fl. Bor. Am. 1:30, t. 13 (1829), type loc. Northwest Coast, *Menzies.*

LAURACEAE. Laurel Family.

Aromatic evergreen trees and shrubs with alternate simple leaves and no stipules. Flowers perfect, regular. Petals none. Anthers opening by uplifted valves. Ovary superior, 1-celled, 1-ovuled, with a single style. Fruit in ours a drupe.—Genera 39 and species about 1000, all continents, often in the temperate zones but mostly tropical.

1. UMBELLULARIA Nutt.

Flowers in simple peduncled umbels. Sepals 6. Stamens 9, the three inner with stipitate orange-colored gland on each side of the filament at base and alternating with scale-like staminodia; anthers 4-celled, 4-valved, the three inner extrorse, the outer introrse.—Species 1. (Latin umbellularia, a little umbel.)

1. **U. californica** Nutt. California Laurel. (Fig. 110.) Tree 20 to 60 feet high with a dense crown of erect slender branches, or in the chaparral as a mere shrub; leaves oblong or oblong-lanceolate, entire, 2½ to 4½ inches long, on short petioles; peduncles in the terminal axils, 4 to 7 lines long; umbels 4 to 9-flowered but only 1, 2 or 3 flowers set in fruit; sepals 1½ lines long; drupe subglobose or ovoid, 1 inch long, greenish or when ripe, brown-purple.

Mountain cañons and valley flats of the Coast Ranges and Sierra Nevada, south to San Diego Co. and north to southern Oregon. Very common.

Biol. and Econ. Note.—This tree takes on a variety of forms in different situations. It becomes: (*a*) a large tree in cañon flats, rich valleys or river bottoms; (*b*) gregarious in cañons, where its low colonies are often wind-controlled; (*c*) a small tree or bush on rock outcropping in the hills; (*d*) a slender dwarf 3 to 6 feet high in the chaparral; and (*e*) prostrate on the ocean bluffs, forming mats 1 to 2 feet high and 10 to 15 feet broad. As a large tree it is most abundant and of greatest size on the alluvial river flats of northwestern California and adjacent Oregon. The wood is odorous, heavy, hard and strong and takes a high polish. It is used for staves, shoe-lasts, turned articles, furniture and interior finish and is especially prized by the cabinet maker. It is also called Bay Tree and Bay-Laurel. In the woods of Mendocino and Humboldt cos. it is known as Pepperwood and in Oregon as Myrtle.

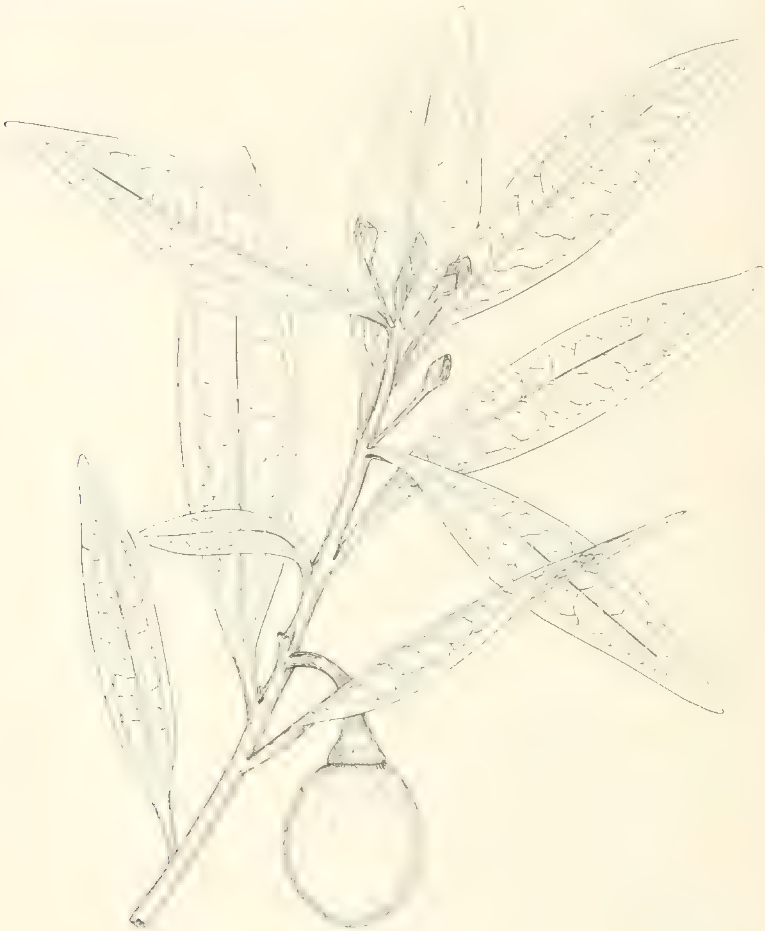

Fig. 110. Umbellularia californica Nutt. Fruiting branchlet, × 1.

Locs.—East Fork Illinois River, Del Norte Co., *Jepson;* Myers Ranch, South Fork Eel River, *Tracy* 5101; Cahto, *Jepson;* Elk Creek, Mendocino Coast, *Jepson;* Mill Creek, Ukiah, *Jepson;* Cloverdale, *Jepson;* St. Helena, *Jepson;* Twin Sisters Peak, w. Solano Co., *Jepson* 2393; Mt. Tamalpais, *Jepson;* Berkeley, *Jepson;* Mt. Diablo, *Jepson;* Swanton, Santa Cruz Co., *Jepson;* San Antonio Trail, Santa Lucia Mts., *Jepson.* Sierra Nevada: Elsie Creek, Amador Co., *Hansen* 210; Gwin Mine, Calaveras Co., *Jepson;* Patterson Grade, Stanislaus Co., *A. L. Grant* 559; Hetch-Hetchy, *Jepson;* Cedar Creek, Sequoia Park, *Jepson;* South Fork Kaweah River, *Jepson.* Southern California: Santa Inez Mts., *Brewer* 326; Santa Monica Cañon, *J. H. Barber* 7; San Antonio Cañon, *C. F. Baker* 3686; Mt. Ontario, *Aurelia S. Harwood;* San Jacinto Mts., *Hall* 520.

Refs.—Umbellularia californica Nutt. N. Am. Sylv. 1:87 (1842); Jepson, Fl. W. Mid. Cal. 191 (1901), Silva Cal. 242, pls. 10, 76 (1910)

Jepson, Flora of California, vol. 1, pt. 7, pp. 529–552, Oct. 19, 1921.

PAPAVERACEAE. Poppy Family

Herbs or shrubs with mostly colored juice and regular complete flowers. Sepals 2 or 3, caducous, the petals twice as many. Calyx in Eschscholtzia resembling a fool's cap, the 2 sepals completely united into a single piece. Stamens numerous, rarely few. Pistil 1, composed of 2 to several united carpels; ovary superior, 1-celled (several-celled in Romneya); in Platystemon the lightly united carpels become distinct in fruit.—Genera 23 and species about 100, mostly extratropical in the north temperate zone.

Bibliog.—Harvey, W. H., Description of a new Genus of Papaveraceae detected by the late Dr. Coulter in California (Lond. Jour. Bot. 4:73-76, t. 3,—1845). Gray, A., Character of Canbya and Arctomecon (Proc. Am. Acad. 12:51-53, pls. 1, 2,—1876); [N. Am. genera of] Papaveraceae (Proc. Am. Acad. 22:270-273,—1887). Brandegee, K., Papavereae of the Pacific Coast (Proc. Cal. Acad. 1:237-251,—1889); Variations of Platystemon and Eschscholtzia (Zoe 1:278-282,—1890). Brandegee, T. S., Deformed flowers of Dendromecon (Zoe 1:46-48, pl. 1,—1890); Notes on Papaveraceae (Zoe 5:174-177,—1903). Prain, D., An Account of the Genus Argemone (Jour. Bot. 33:129-135, 176-178, 207-209, 307-312, 325-333, 363-371,—1895). Greene, E. L., Platystemon and its Allies (Pitt. 5:139-194,—1903); Revision of Eschscholtzia (Pitt. 5:205-293,—1905); A Study of Dendromecon (Pitt. 5:295-306,—1905). Fedde, F. von, Was ist Platystemon leiocarpum F. & M. (Ber. Deutsch. Bot. Ges. 22:92-95, figs. 1-2,—1904); Eschscholtziae gen. sp. nov. (Rep. Nov. Sp. 2:145-148; 3:27-28, 75-76, 105, 183-185,—1906); Papaveraceae-Hypecoideae et Papaveraceae-Papaveroideae (Engler, Pflzr. 4^{104}:1-430, figs. 1-43,—1909).

Sepals distinct, caducous; receptacle not hollowed (slightly hollowed in no. 6).
Leaves usually opposite or whorled, entire.
Stamens numerous; carpels lightly joined, distinct in fruit..........1. PLATYSTEMON.
Stamens 6 to 12 or numerous; carpels combined into a 3-angled or linear ovary..........2. MECONELLA.
Leaves alternate or mainly so, often in a basal tuft.
Stamens 6 to 9; minute annual..........3. CANBYA.
Stamens many or numerous.
Herbs; leaves toothed, lobed or pinnatifid.
Petals deciduous; stigmas opposite (that is, over) the placentae.
Flower buds erect; petals white; herbage prickly..........4. ARGEMONE.
Flower buds drooping; petals red; herbage not prickly..........5. PAPAVER.
Petals persistent around the capsule; stigmas alternate with the placentae; herbage not prickly..........6. ARCTOMECON.
Shrubs or at least woody at base.
Petals white; leaves pinnatifid; capsule ovate, 7 to 12-valved..........7. ROMNEYA.
Petals yellow; leaves entire or merely denticulate; capsule linear, 2-valved..........8. DENDROMECON.
Sepals united into a calyptra or foolscap body which is pushed off by the 4 expanding petals; receptacle hollowed..........9. ESCHSCHOLTZIA.

1. PLATYSTEMON Benth.

Low annual with mainly opposite entire leaves. Sepals 3. Petals 6 in two series, tardily deciduous, withering and closing over the forming fruit. Stamens numerous; filaments more or less dilated and petal-like. Stigmas subulate-filiform, one terminating each carpel; carpels 6 to 17 or 20, each several-ovuled, connivent or coherent in a circle, becoming moniliform, at maturity separating and breaking transversely into indehiscent 1-seeded joints. Species 1, southwestern United States and Lower California. Anthesis lasting for more than one day. (Greek platus, broad, and stemon, a stamen.)

1. **P. californicus** Benth. Cream Cups. (Fig. 111.) Branched from the base, the branches widely spreading and more or less decumbent, or often erect, 3 to 9 (or 12) inches high, the leaves often borne on the lower part (or wholly basal) and the peduncles therefore more or less scape-like and 2 to 7 (or 10) inches long; herbage pilose; buds round-obovoid, elliptic or oblong, long-hairy; petals commonly cream yellow, 3 or 6 to 11 lines long.

Foothills, plains and valleys, in sandy or clay soils, common almost throughout California, but absent from the deserts, except the western margins of the Colorado and Mohave. East to Arizona and Utah; south to Lower California.

Note on Variability.—Platystemon californicus is a plant of fairly uniform habit and fairly uniform vegetative characters. Its stems, mode of branching and its leaves are essentially constant, although individuals vary in amount of hairiness. Its flowers are nearly uniform in size and shape, and reasonably constant in size, shape and number of the parts in the calyx and corolla circles. The androecium sometimes exhibits marked variability, but of the two inner circles of the flower, variation affects more strongly the gynoecium. Variations in the carpellary circle frequently become strikingly pronounced and highly eccentric and irregular in character. The carpels are indeed highly variable in the degree to which they become moniliform in fruit and this fact is undoubtedly correlated with fertilization of the ovules. Under normal fertilization the carpels become strongly moniliform (Fig. 112*c*), the beads indicating the position of the seeds. On the other hand torulose carpels are commonly without seeds or sometimes with one or two (Fig. 112*d*). In some cases a mature carpel contains one or two distinct beads each with a seed at its center, while the remainder of the carpel is beadless, dissection showing that the beadless portion is vacant and seedless. It seems evident that moniliform carpels are those which have developed seeds, and torulose (or cylindric) carpels those which have failed or partially failed to develop seeds.

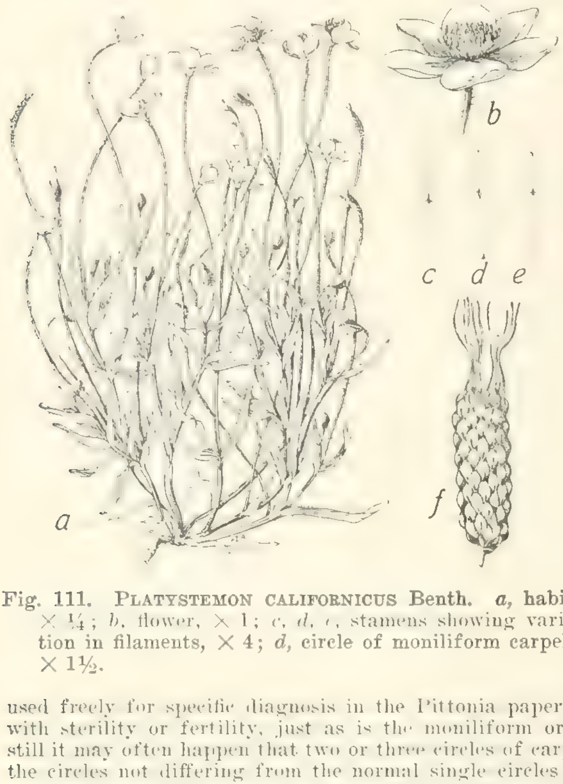

Fig. 111. **Platystemon californicus** Benth. *a*, habit, × ¼; *b*, flower, × 1; *c*, *d*, *e*, stamens showing variation in filaments, × 4; *d*, circle of moniliform carpels, × 1½.

Greene's segregates of Platystemon californicus (Pitt. 5:158–194) are 52 in number (one of them a revival). The primary division of his key, as well as various subdivisions, rests upon characters of the carpels, especially upon the distinction "carpels torulose" or "carpels moniliform." Since moniliform carpels have been shown to be those whose seeds have developed, and torulose carpels those whose seeds have not developed, the uneasy foundation of these segregates is disclosed. In some cases, as will be shown below, both cylindric and moniliform types of carpels may be found on a single individual (spms. from San Diego, *K. Brandegee*). This one fact goes far to cancel most of the numerous specific segregates of Greene and Fedde, and much other evidence tends to destroy the others or cast a heavy shadow of doubt upon them.

The carpels furthermore vary greatly in hairiness, a character used freely for specific diagnosis in the Pittonia paper. Possibly this character is correlated with sterility or fertility, just as is the moniliform or torulose character. More remarkable still it may often happen that two or three circles of carpels will be produced in a single flower, the circles not differing from the normal single circles of other flowers on the same plant or on other plants of the same collection (Fig. 112). In other words, a single flower often bears 2 or 3 pluricarpellary gynoecia, each gynoecium composed of a circle of regular carpels.

In the following attempted brief analysis of variability in this species it has been found difficult to cite the segregates published in Pittonia or in the Pflanzenreich, for the reason that while a single character may be repeated in a second collection, no set of characters of a collection has been found wholly repeated in another collection from another locality, or often indeed from the same locality. We thus have at least partial explanation of the solitary citations of specimens in Fedde's account of the genus in Engler's Pflanzenreich, bd. 4, teil 104, where he recognizes 57 species. Of these, 33 are indicated by only a single collection, while 10 more are credited with only two collections.

I. VARIATION IN HABIT OR IN VEGETATIVE ORGANS

1. Tendency to nanism. Plants in sterile or clay soils tend to be smaller, less branched, or commonly with the leaves in a basal tuft and the flowering stems scape-like: Crane Creek, w. Tehama Co., *Jepson;* Ft. Seward Ridge, *Jepson* 1902; Kelseyville, Lake Co., *Chandler;* betw. Coalinga and Parkfield, *K. Brandegee.*

2. Tendency to strong foliation. Plants in sandy or moist soils show luxuriant leafy stems: Humboldt Bay, *Tracy* 2046; Olema, *Jepson* 8283; Ingleside, *Jepson* 2528.

3. Tendency to extreme crinitism. Plants of the interior towards the south, especially in the southern Sierra Nevada and neighboring ranges, show a tendency to extreme hairiness of stems, buds or fruits (especially when young): Springville, Tulare Co., *Purpus* 1749. Cf. *P. horridulus* Greene and *P. villosus* Greene. Continuous intergrades are represented by spms. from Ft. Tejon, *Hall* 6290, Caliente, Kern Co., *Jepson* 6756, Caliente Creek, *Davy* 1934.

II. Variation in reproductive organs

1. Calyx. (*a*) The flower buds are commonly obovoid but sometimes globose. The globose character is not definitely correlated with other characters. (*b*) The usual form of calyx is moderately pilose with somewhat scattered hairs; sometmes it is very hairy (Erskine Creek, Kern Co., *Purpus* 5000) or excessively hairy (Springville, Tulare Co., *Purpus* 1749). There are regular intergrades from these extreme states to the ordinary form.

2. Corolla. The corolla is commonly saucer-shaped but is sometimes rotate or turbinate at base. The petals are commonly cream color. The following color variations may be noted: (*a*) A deeper or yellow color occurs at apex, with this color sometimes repeated as a spot at base. (*b*) The petals are yellow throughout: sand dunes, Little River beach (Humboldt Co.), *Tracy* 4797. (*c*) The petals are sometimes lemon yellow with white base: Humboldt Bay, *Tracy* 2020 (which is, save for color, exactly the same as *Tracy* 2034, same loc., petals creamy white throughout). (*d*) The petals are pure white: Poso Creek, Greenhorn Range, *Hall & Babcock* 5016. (*e*) The petals are white with definite yellow blotch at base: Poso Creek, *Hall & Babcock* 5018. (*f*) The petals are white with definite yellow blotch at base and another at tip: Poso Creek, *Hall & Babcock* 5069 (the three preceding numbers of Hall & Babcock differ only in color of petals). (*g*) The petals are sometimes deep rose pink outside on the upper half. (*h*) The petals are reddish tipped in spms. from Priest Valley, se. Monterey Co., *Jepson* 2687, but a dupl. sheet shows the normal cream color. Cf. *P. purpuratus* Greene; *P. antoninus* Greene; *P. obtectus* Greene var. *sanctarum* Greene. The petals are normally entire; however in spms. from near the coal mines betw. Antioch and Marsh Creek, *K. Brandegee*, some of them are weakly lobed, especially the outer.

3. Stamens. The filaments are usually dilated, the outer ones broader than the inner (fig. 111). The following variations may be noted: (*a*) The filaments are very broad and 3-toothed at apex in a plant from Tiburon, *K. Brandegee*, but other plants in same collection have narrower filaments which are not 3-toothed. Cf. *P. heterander* Greene and *P. subereus* Greene. (*b*) The outer filaments are moderately broad: Pt. Richmond, *Hall* 1654, and Ocean View, San Francisco Co., *K. Brandegee* (in the latter the outer filaments are obcordate or retuse). In many specimens the outer filaments are often 2-toothed with the inner filaments entire.

4. Carpels: (*a*) Many specimens have flowers showing a tendency to produce two or three distinct pluricarpellary circles, the fruiting carpels being extremely hairy (especially when immature). In some such specimens the beads of the fruit are not well rounded but are more or less cylindric: Riverside, *Brandegee & Wilder;* Marysville Buttes, *Heller* 11246. In other cases the fruits have the beads well rounded: Coahuilla Valley, Riverside Co., *Jepson* 1470. Such double or triple circles of carpels are teratological and are borne on plants with single or normal circles and often show intergrade states. (*b*) Other specimens have flowers showing a tendency to produce two distinct pluricarpellary circles, the fruiting carpels not at all hairy: San Felipe Valley, e. San Diego Co., *Jepson* 8734; Hog Cañon, San Bernardino Valley, *Parish* 5746 (in one flower there are 3 carpellary circles); Oceanview, San Francisco, *K. Brandegee* 10p. Such extra circles of non-hairy fruits are likewise teratological. (*c*) Many specimens have torulose carpels which are empty or 1 or 2 seeded and hairy (sometimes densely so): Bardin's Switch betw. Castroville and Monterey, *K. Brandegee* 2a, 2b, 2d, 2f, 2p, 3p, 4p; Riverside, *Brandegee & Wilder* 2: Botanic Garden, Berkeley, plants from Lake Merced (San Francisco) seed, *K. Brandegee* (anthers apparently never producing pollen). Cf. *P. capsularis* Greene; carpels seedless except externally, that is within the cavity formed by union of the carpels, rarely torulose and breaking into 1 seeded joints (ex. char.). (*d*) Moniliform carpels, usually glabrous or nearly so, are frequently found, each bead denoting the position of a seed: Ocean View, San Francisco, *K. Brandegee* 5p, 6p, 7p; betw. Antioch and Marsh Creek, *K. Brandegee*. (*e*) Again we have specimens in which the types of carpels in *c* and *d* are present as to shape and seed, but conspicuously hairy (as often in *c*): Ocean View, San Francisco Co., *K. Brandegee*

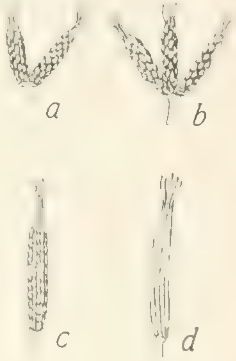

Fig. 112. Platystemon californicus Benth. *a*, flower bearing 2 distinct gynoecia, each gynoecium composed of several normal carpels; *b*, flower with 3 gynoecia; *c*, *d*, flowers with moniliform and cylindric carpels borne on the same plant.

8p. (*f*) Sometimes we have very interesting specimens which bear on the same plant both moniliform carpels with rounded beads and carpels in which the beads are short-cylindric instead of rounded, all seed-bearing: San Diego (ocean cliffs), *K. Brandegee* 1p. Cf. *P. sphaerocarpus* Greene. (*g*) In other cases the fruiting carpels are unusually long (9 to 11 lines), the carpels each with an obvious dorsal keel: Sutter plains, *Jepson;* Antioch to Marsh Creek, near the coal mines, *K. Brandegee* a. Cf. *P. emarginatus* Greene. (*h*) The fruiting carpels are sometimes twisted and either sterile or fertile: Ocean View, San Francisco, *K. Brandegee* 12p, 13p, 14p, 15p. Cf. *P. contortus* Greene, based on a spm. from Lake Co., or Colusa Co., *Curran.* (*i*) There is frequently a tendency to extreme hairiness of carpels. This variation seems correlated with extreme hairiness of stems and buds, especially when young: Springville, Tulare Co., *Purpus* 1749. On the other hand the reverse correlation is not true, since *Purpus* 5000 (Erskin Creek, Kern Co.) has very hairy buds and stems, but glabrous carpels.

It is possible that further collections and field studies may show some of the specific segregates, listed below as reductions, to be of varietal rank, but it is more likely that accumulation of knowledge concerning the range and kind of variation will destroy this possibility. No other Californian species seems so inviting for a study of fluctuating variability, particularly in intensive garden cultures. It is probable that such work would reveal the most unexpected surprises.

Locs.—Coast Ranges: Dinsmore Ranch, near Buck Mt., Humboldt Co., *Tracy* 4139; Fort Seward Ridge, Humboldt Co., *Jepson* 1902 (3000 ft.); Cahto, Mendocino Co., *T. Brandegee;* Snow Mt., Lake Co., *T. Brandegee;* Sites, Colusa Co., *K. Brandegee;* St. Helena, *Jepson* 6240; Yountville, *Jepson;* Berkeley, *Jepson;* Moraga Valley, *Jepson;* Crystal Springs Lake, San Mateo Co., *C. F. Baker* 433. Great Valley: Crane Creek, Salt Creek and Wimmeshaw, w. Tehama Co., *Jepson;* Chico, *Heller* 10718; Sutter plains, *Jepson;* Wilson Creek, Vacaville, *Jepson;* Tracy, *C. F. Baker* 2780; Madera, *Davy* 1697. Sierra Nevada: Weber Creek, Eldorado Co., *K. Brandegee;* Phoenix Lake, Tuolumne Co., *A. L. Grant* 50; Greenhorn Range, *Hall & Babcock* 5016. Southern California: Swarthout Cañon, San Antonio Mts., *Hall* 1520; Colton, *Parish;* Thomas Valley, San Jacinto Mts., *Hall* 543; Ramona, *Jepson* 8514; San Felipe Valley, e. San Diego Co., *Jepson* 8734.

Var. **crinitus** Greene. Peduncles and buds with longer hairs, often densely pilose; buds globose; petals yellow, often with pink or greenish tips—Tehachapi Mts. south to the Cuyamaca Mts.: Tehachapi, *Greene;* Coahuilla Valley, Riverside Co., *Jepson* 1470. This variety is not definitely different from the species but merely represents a terminus of a line of variation.

Var. **horridulus** Jepson n. comb. Petals spreading nearly rotately from a turbinate or almost cylindric base 3 to 4 lines long; carpels white when young with a dense covering of stiffish hairs, the hairs rapidly deciduous and the carpels soon becoming only thinly hairy.—Southern Sierra Nevada foothills from Fresno Co. to Tulare Co., 3500 to 5000 ft.: ridge n. of Pinehurst, Fresno Co., *Ottley* 1438, *Newlon* 202; e. of Springville, Tulare Co., *Purpus* 1749. The following spms. have carpels destitute of the heavy coat of hairs just described, being in pubescence similar to the ordinary form of Platystemon californicus, but they have turbinate corollas in various degrees or intergrades: Pleasant Cañon, Panamint Mts., *Hall & Chandler* 6958; Erskine Creek, Kern Co., *Purpus* 5000; Leonis Valley, betw. Manzana and Gorman, *Davy* 2659. These facts evidence that the corolla character is more constant than the pubescence character, although the latter is the more striking. In those plants (as first cited above) where both characters are found intensified we have a state which is really an extreme in a series of variations.

Var. **nutans** Brandegee. Fruits nodding. Coast of Southern California; San Diego, *T. Brandegee;* Santa Cruz Isl., *T. Brandegee.*

Refs.—PLATYSTEMON CALIFORNICUS Benth. Trans. Hort. Soc. Lond. ser. 2, 1:405 (1835), type from Cal., *Douglas;* Jepson, Fl. W. Mid. Cal. 205 (1901). Var. CRINITUS Greene, Fl. Fr. 282 (1892). *P. crinitus* Greene, Pitt. 2:13 (1889), type loc. Tehachapi, *Greene.* Var. HORRIDULUS Jepson. *P. horridulus* Greene, Pitt. 5:178 (1903), type loc. betw. Sequoia and Sanger Mills, Fresno Co., *Eastwood.* Var. NUTANS Brandg. Zoe 5:177 (1903), type loc. San Diego, *T. Brandegee. P. nutans* Greene, Pitt. 5:192 (1903).

The following additional segregates are here alphabetically arranged: *P. aculeolatus* Greene, Pitt. 5:167 (1903), type loc. Santa Barbara Isl., *Trask;* depressed, about 5 inches broad; corolla ¼ inch broad (ex. char.). *P. acutatus* Greene l.c. 187, type loc. Middle Tule River, *Purpus;* Fedde in Engler, Pflzr. 4^{104}:126, fig. 18A-C (1909). *P. anemonoides* Greene, l.c. 177, type loc. Alcalde, w. Fresno Co., *Eastwood. P. antoninus* Greene l.c. 180, type loc. San Antonio River, Santa Lucia Mts., *Eastwood. P. arvorum* Greene l.c. 174, type loc. Tracy, *C. F. Baker* 3199. *P. californicus* var. *sphaerocarpus* T. Brandegee, Zoe 5:177 (1903), type loc. Colusa Jct., *T. Brandegee. P. capsularis* Greene l.c. 165, type loc. San Simeon, *T. Brandegee;* Fedde l.c. 116, fig. 15C. *P. communis* Greene l.c. 169, type loc. San Rafael, *J. P. Moore;* Fedde l.c. 117, fig. 15E *a-c;* var. *stylosus* Greene l.c. 170, based on spms. from San Francisco Co., *Kellogg & Harford*, and Redwood Cañon, Marin Co., *Michener & Bioletti;* Fedde l.c. 117, fig.

15E*d*. *P. cernuus* Greene l.c. 193, type loc. Santa Catalina Isl., *Trask;* Fedde l.c. 131, fig. 18R, S. ***P. commixtus*** Greene l.c. 176, type loc. Lake Co. or Colusa Co. *P. contortus* Greene l.c. 175, based on a spm. from Lake Co. or Colusa Co., *Curran.* *P. crenatus* Greene l.c. 175, type loc. Lake Co. or Colusa Co., *Curran.* *P. elegans* Greene l.c. 178, type loc. San Emigdio, Kern Co., *Eastwood.* *P. emarginatus* Greene l.c. 172 (1903), type loc. foothills near Stanford, *C. F. Baker* 665. *P. exsculptus* Greene l.c. 182, type loc. Antioch, *Brandegee;* Fedde l.c. 123, fig. 16H, J. *P. glyptolobus* Greene l.c. 182, type loc. Lakeport, *C. F. Baker* 3058. *P. greeneanus* Fedde, Ber. Deutsch. Bot. Ges. 22:94, fig. 2 (1904), based on Mendocino, *H. E. Brown* 811, and Bodega Point and Point Reyes, *Eastwood;* Engler, Pflzr. 4^{104}:114, fig. 15B (1909). *P. hallii* Fedde l.c. 130, fig. 18N, type loc. Kenworthy, San Jacinto Mts., *Hall* 1144. *P. heterander* Greene l.c. 181, type loc. Butte Co. foothills, *C. C. Bruce.* *P. hispidulus* Greene l.c. 193, type loc. San Nicolas Isl., *Trask;* Fedde l.c. 131, fig. 18P, Q. *P. hyacinthinus* Greene l.c. 180, type loc. Thomas Valley, Mt. San Jacinto, *Hall* 543; Fedde l.c. 121, fig. 16F, G; approaches closely *P. crinitus* Greene. *P. intermedius* Fedde l.c. 119, type loc. Alameda Co., *W. P. Gibbons.* *P. leptander* Greene l.c. 190, type loc. Huron, Fresno Co., *T. Brandegee.* *P. leucanthus* Greene l.c. 188, type loc. San Bernardino foothills, *Parish.* *P. loesenerianus* Fedde l.c. 128, type loc. Riverside, *Hall* 3794. *P. mendocinus* Greene l.c. 181, Cahto, Mendocino Co., *Eastwood.* *P. microlobus* Greene l.c. 189, type loc. Arroyo Grande, *Alice King.* *P. nigricans* Greene l.c. 174, type loc. Midway sta., e. of Livermore, *Greene;* Fedde l.c. 118, fig. 15J. *P. obtectus* Greene l.c. 186, type loc. Witch Creek, San Diego Co., *R. D. Alderson;* Fedde l.c. 124, fig. 17; var. ***sanctarum*** Greene l.c. type loc. Santa Lucia Mts., *Eastwood.* *P. ornithopus* Greene l.c. 167, type loc. Santa Barbara Isl., *Brandegee.* *P. pectinatus* Greene l.c. 184, type loc. Alcalde, Fresno Co., *Eastwood.* *P. penicillatus* Greene l.c. 185, type loc. "Santa Maria Mts." *P. petrinus* Greene l.c. 166, type loc. San Pedro, *Brandegee.* *P. pilosellus* Greene l.c. 185, type loc. Madera, *P. S. Buckminster.* *P. proximus* Greene l.c. 172, type loc. Chico, *R. M. Austin, H. E. Brown;* Fedde l.c. 118, fig. 15F. *P. purpuratus* Greene l.c. 168 based on spms. from Monterey and Castroville, *Brandegee, Greene.* *P. quercetorum* Greene l.c. 173, type loc. Oakland, *Chesnut;* Fedde, l.c. 120, fig. 15H. *P. rugosus* Greene l.c. 183, type loc. Pilot Ridge, Eldorado Co. foothills, *Eastwood.* *P. setosus* Greene l.c. 194, type loc. Santa Barbara Isl., *Trask.* *P. sphaerocarpus* Greene l.c. 168, type loc. Colusa Jct., *T. Brandegee;* Fedde l.c. 117, fig. 15D. *P. subereus* Greene l.c. 184, type loc. Colusa Co., *Brandegee.* *P. tesselatus* Greene l.c. 171, type loc. Briones Hills, Contra Costa Co., *Greene.* *P. tortuosus* Greene l.c. 170, type loc. Tracy, *C. F. Baker* 2780. *P. turbinatus* Greene l.c. 188, type loc. Visalia, *T. J. Patterson;* Fedde l.c. 127, fig. 18D. *P. tympaniferus* Fedde l.c. 124, fig. 16K, L, type loc. Kenworthy, San Jacinto Mts., *Hall* 1144. *P. verecundus* Greene l.c. 191, type loc. San Diego, *Greene;* Fedde l.c. 130, fig. 18O. *P. villosus* Green l.c. 165, type loc. Bodega Pt., *Eastwood.*

2. MECONELLA Nutt.

Annual herbs with opposite leaves. Sepals 3, rarely 2. Petals 6, rarely 4, deciduous. Stamens 6 to 12, or numerous. Carpels 3, combined into a single 1-celled ovary, which is 3-lobed or nearly terete. Placentae as many as the carpels, parietal, many-ovuled. Stigmas ovate to subulate. Capsule completely 3-valved, dehiscent through the placentae.—Species 2, California to British Columbia. (Greek mekon, poppy, and ella, dimmutive.)

Plants with the leaves all basal or sub-basal and with unbranched hairy scapes; petals light yellow; ovary and capsule narrowly obovoid, 3-lobed..1. *M. linearis.*

Plants with branching leafy stems and glabrous peduncles; petals white; ovary and capsule linear..2. *M. oregana.*

1. **M. linearis** Jepson n. comb. (Fig. 113.) Plants with the leaves all basal or nearly so, the scapes 4 to 8 inches high and hispid with spreading hairs; leaves linear, 1 to 2¼ inches long, sessile; sepals brownish; petals light yellow, cuneate-orbicular or obovate, 4 to 9 lines long; stamens numerous, filaments linear or oblong-dilated, rarely filiform; body of capsule 5 to 7 lines long.

Sandy soil in the Coast Ranges from Sonoma Co. to Santa Barbara Co., chiefly near the coast, but inland to the southern Sierra Nevada (Fresno Co. to Kern Co.); north to Oregon. Mar.-Apr.

Locs.—Sierra Nevada: near Fresno, *Heaton;* Kaweah, *Hopping* 254; Keene sta., Kern Co., *Heller* 7807. Coast Ranges: Santa Barbara Co., *Summers* 21; Castroville, *K. Brandegee;* San Francisco, *C. E. Michener* (*Hesperomecon platystemon* Greene); Oakland, *Holder* 2521; Antioch, *Chesnut & Drew* (*Hesperomecon angustum* Greene).

Note on variation.—The filaments are narrowly linear to oblong, rather rarely filiform. Filiform filaments may frequently be found in the same flower with broader filaments, especially in the case of dwarfed plants: Rowen, Tehachapi Range, *Jepson* 6715; betw. Marcell and

Keene, Kern Co., *K. Brandegee* 98; San Francisco, *K. Brandegee* 1x. There is no definite constancy yet worked out between filament breadth and other characters. The ground color of the petals is mostly cream color with a yellow phase at base; the outer 3 are often deep yellow, egg-yellow, or egg-yellow and cream in varying proportions, or with a yellow central splotch. Sometimes the flowers are white with yellow center, sometimes the flowers fade to rose-pink. The striking color form, var. **pulchellum** Jepson n. comb., has the outer petals yellow, the inner white, but this color scheme is not correlated definitely with any other characters; it occurs on the Sonoma Co. and San Francisco Co. coasts.

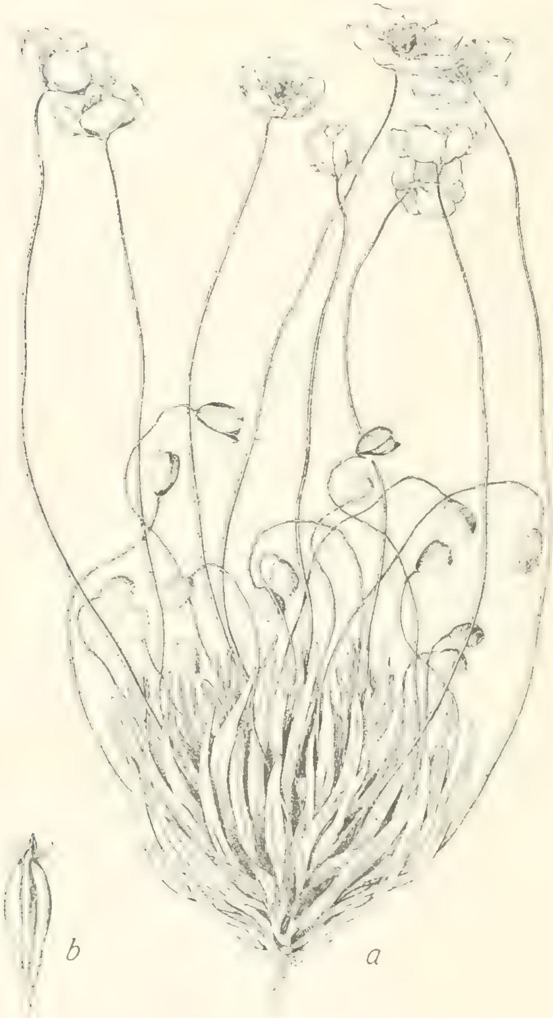

Fig. 113. MECONELLA LINEARIS Jepson. *a*, habit, × 1; *b*, capsule, × 1.

Refs.—MECONELLA LINEARIS Jepson. *Platystigma lineare* Benth. Trans. Hort. Soc. ser. 2, 1:407 (1835), type a garden plant (Cal. seed, *Douglas*); Hook. Ic. Pl. t. 38 (1836), filaments linear-filiform, Monterey, *Douglas;* Jepson, Fl. W. Mid. Cal. 206 (1901). *Hesperomecon affine* Greene, Pitt. 5:147 (1903), type loc. Exeter, *Eastwood,* is intermediate between the species and *H. platystemon* Greene, that is the filaments are filiform, the outer dilated. *H. platystemon* Greene l.c. 148 (1903), type loc. San Francisco, *Kellogg. H. strictum* Greene l.c. 149 (1903), type loc. San Luis Obispo, *Parry. H. angustum* Greene l.c. 149 (1903), type loc. Antioch sand hills, *Greene. H. luteolum* Greene l.c. 150 (1903), based on spms. from Ben Lomond (Santa Cruz Co.) and Castroville (Monterey Co.), *T. Brandegee.* Var. PULCHELLUM Jepson. *H. pulchellum* Greene l.c. 150 (1903), based on Bot. Reg. t. 1954 (1837), an illustration of a garden plant, the seed originally from Fort Ross, Sonoma Co.; cf. also Hook. Bot. Mag. t. 3575 (1837).

2. **M. oregana** Nutt. var. **californica** Jepson n. comb. (Fig. 114.) Very slender, erect, branching, 4 to 7 inches high, glabrous throughout; leaves entire, the basal and lower ones elliptic to obovate-spatulate, ½ to 1 or 1½ inches long, commonly contracted to a petiole, the upper cauline oblanceolate to linear; peduncles 2 to 3 inches long, erect in anthesis, in fruit deflexed almost horizontally but the capsule vertical or nearly so; sepals often reddish; petals white, elliptic to oblong, 2 to 5 lines long; stamens 12, unequal, in two series, the outer shorter; filaments filiform or slightly dilated upwards; capsule linear, twisted, ½ to 1 (rarely 1½) inches long.

Sierra Nevada foothills from Shasta Co. to Amador Co.; San Francisco Bay region; extending south in the Sierra foothills and to cismontane Southern California in slightly modified forms.

Locs.—Little Chico Creek, *R. M. Austin;* Sweetwater Creek, Eldorado Co., *K. Brandegee;* Auburn, *Bolander* 4524; Berkeley Hills, *Chandler* 884; San Bruno Hills, *Jepson.* The species is variable, like its allies and the following varieties may be, with the further results of field studies, shown to be mere forms: Var. **octandra** Jepson n. comb. Petals almost fan-shaped; stamens 8, the 4 outer shorter.—Southern Sierra foothills (or their bordering plains) from Merced Co. to Tulare Co.: Merced, *T. Brandegee;* Kaweah, *Hopping.* Var. **denticulata** Jepson n. comb. Leaves entire, sometimes denticulate; stamens 6, in one set.—Cismontane Southern California: Santa Inez Mts. near Santa Barbara, *T. Brandegee;* Santa Cruz Isl., *T. Brandegee;* Millards Cañon, San Gabriel Mts., *Peirson* 36; San Bernardino, *Parish;* Ramona, *T. Brandegee.*

Refs.—MECONELLA OREGANA Nutt.; T. & G. Fl. 1:64 (1838), type loc. lower Willamette Valley, *Nuttall;* var. CALIFORNICA Jepson. *M. californica* Torr. in Frem. Rep. Sec. Exped. 312 (1845), type loc. American River, doubtless in the Sierra foothills, *Fremont. Platystigma californicum* Brew. & Wats. Bot. Cal. 1:20 (1876); Jepson, Fl. W. Mid. Cal. 206 (1901). *M. collina* Greene, Pitt. 5:143 (1903), type loc. San Bruno Hills, *Kellogg.* Var. OCTANDRA Jepson. *M. octandra* Greene l.c. 142, type loc. Salt Creek, Kaweah River, *Eastwood.* Var. DENTICULATA Jepson. *M. denticulata* Greene, Bull. Cal. Acad. 2:59 (1886), type loc. Temecula Cañon, n. of Mission San Luis Rey, San Diego Co., *Greene. Platystigma denticulatum* Greene, Bull. Torr. Club 13:218 (1886). *M. kakoethes* Fedde, Rep. Nov. Sp. 3:275 (1907), type loc. San Diego, *Orcutt.*

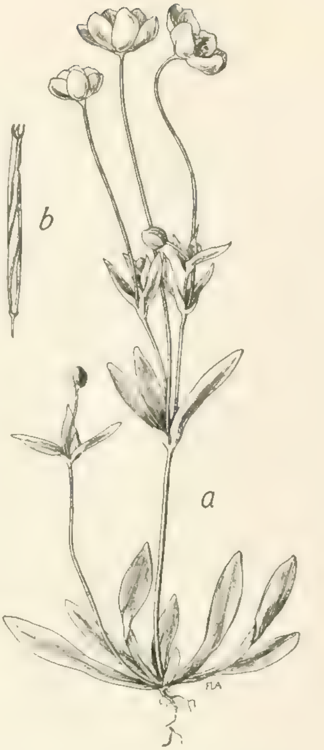

Fig. 114. MECONELLA OREGANA Nutt. var. CALIFORNICA Jepson. *a*, habit; *b*, capsule. × 1.

3. CANBYA Parry

Minute glabrous annuals with the leaves crowded in a dense basal tuft on the very shortly branched stems. Leaves mostly alternate, linear, fleshy, entire. Flowers on axillary filiform pedicels. Sepals 3. Petals 6, white, after anthesis withering and closing over the capsule. Stamens 6 (or 5) to 9. Ovary 1-celled, with 3 nerve-like placentae. Style none. Stigmas 3, linear, radiate-recurved and appressed to the subglobose ovary. Ovules several.—Species 2, California and Oregon. (W. M. Canby, botanist of Delaware.)

1. **C. candida** Parry. (Fig. 115.) Plants 1 inch high; leaves fleshy, 2 to 4 lines long; petals roundish, 1 to 1¾ lines long.

Sandy washes, Mohave Desert, 2000 to 3500 feet. Apr.-May.

Locs.—Coolgardie yucca mesa, *Jepson* 6703; Calico Wash, ne. of Barstow, *Jepson* 5815; Blacks Ranch near Fremont's Peak, *Hall & Chandler* 6842; Kramer, *K. Brandegee;* near Cajon Pass, *Jepson* 6125; Lancaster, *Davidson;* Little Rock Creek, *Peirson* 2412.

Refs.—CANBYA CANDIDA Parry in Gray, Proc. Am. Acad. 12:51, pl. 1 (1876), type loc. towards head of Mohave River, *Palmer* in 1876.

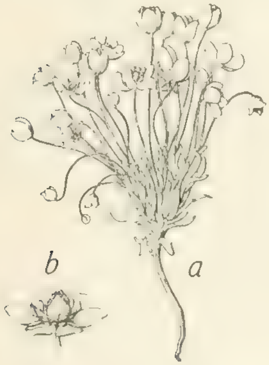

Fig. 115. CANBYA CANDIDA Parry. *a*, plant, × 1; *b*, flower, × 2.

4. **ARGEMONE** L.

Annual herbs with acrid orange juice, prickly sinuate or pinnatifid leaves and flowers erect in the bud. Sepals 2 (often 3), with a horn-like appendage below the apex. Petals white, twice as many as the sepals. Ovary 1-celled; stigmas radiate. Capsule 4 to 6-valved at summit.—Species 6, North and South America, in the tropics and warm temperate regions. (Greek name of some herb, transferred here.)

Calyx rather densely spiny; horn-like appendage of sepals large or conspicuous, spine-tipped and with many spines over its surface; flowers not corymbose..............1. *A. platyceras.*

Calyx with scattered spines; horn-like appendage of sepals small or inconspicuous, spine-tipped, its surface otherwise unarmed; flowers corymbose..................................2. *A. intermedia.*

1. **A. platyceras** Link & Otto. CHICALOTE. Stems stout, branched, more or less prickly with long yellow spines, 1½ to 2¾ feet high; herbage glaucescent; leaves oblong, sinuate-pinnatifid into spinose-toothed lobes, tapering to a winged petiole, spinose chiefly along the margin and along the main veins, 2 to 9 inches long; flowers in leafy-bracteate panicles; sepals 3, spiny, each with a horn at apex, the horns lanceolate, spiny on the sides and strongly spine-tipped; petals 6, obovate, truncate, 1 to 2 inches long; capsule narrowly cylindrical, 1½ to 2 inches long, the valves firm, becoming somewhat indurated, densely spiny.

Southern California. East to Texas. Apr.-July.

Locs.—Tehachapi Valley, *Jepson* 7431; Sisquoc River Valley, Santa Barbara Co., *M. S. Baker;* Mt. Pinos, Ventura Co., *Hall* 6504; San Jacinto Valley, *Reinhardt;* Laguna Mts., San Diego Co., *T. Brandegee;* Split Mt., *T. Brandegee;* Chuckawalla Mts., *Hall* 5970.

Passing by intergrades into the var. **hispida** Prain, the whole plant densely setose-hispid as well as armed with stouter yellow spines.—Coast Ranges; e. side of the Sierra Nevada; mountains of Southern California; 2000 to 8000 feet, June-Sept.: Gravelly Valley, n. Lake Co., *Jepson;* New Idria, San Benito Co., *Brewer* 768; San Antonio Cañon, San Antonio Mts., *Peirson* 55; Burnt Corral Mdw., Little Kern River, *Jepson* 1039; foot of Bloody Cañon, Mono Co., *Chesnut & Drew;* Milford, Lassen Co., *M. S. Baker.* Reno, Nev., *Jepson.*

Refs.—ARGEMONE PLATYCERAS Link & Otto, Ic. Pl. Rar. 1:85, t. 43 (1828), type loc. Hacienda de la Laguna, Conf're de Perote, Mexico. Var. HISPIDA Prain, Jour. Bot. 33:367 (1895). *A. hispida* Gray, Mem. Am. Acad. ser. 2, 4:5 (1849), type loc. Santa Fe, N. Mex., *Fendler* 16 (in part). *A. munita* Dur. & Hilg. Jour. Acad. Phila. ser. 2, 3:37 (1855), type loc. Williamson Pass, *Heermann;* Pac. R. Rep. 5:5, t. 1 (1855).

2. **A. intermedia** Sweet var. **corymbosa** Eastw. PRICKLY POPPY. (Fig. 116.) Plants 1 to 3 feet high, prickly with stout yellow spines; leaves oblong to obovate or the upper ovate, repand-toothed to sinuate-pinnatifid; flowers fragrant, somewhat regularly corymbose; petals 10 to 14 lines (sometimes to 1½ inches) long; capsule ¾ inch long.

Mohave Desert. May-June.

Locs.—Nipton, e. Mohave Desert, *K. Brandegee;* Kelso, *K. Brandegee;* Ludlow, *Jepson* 5499; Blacks Ranch, se. of Fremont's Peak, *Hall & Chandler* 6848; Rabbit Sprs., *Jepson* 5945.

Refs.—ARGEMONE INTERMEDIA Sweet, Hort. Brit. ed. 2, 585 (1830), type from Mexico. Var. CORYMBOSA Eastw., Erythea 4:96 (1896). *A. corymbosa* Greene, Bull. Cal. Acad. 2:59 (1886), type loc. Mohave Desert, *Curran* in 1884; Parish, Bot. Gaz. 65:337 (1918).

5. **PAPAVER** L. POPPY

Erect herbs (ours annual) with narcotic juice. Leaves pinnately cleft, lobed or divided. Flowers showy, solitary on long peduncles, nodding in bud. Sepals 2. Petals 4, in ours red. Stamens very many. Ovary and capsule obovoid to subglobose, with 4 to many intruded placentae. Capsule opening by holes just below the summit.—Species about 50, mostly in Europe, Asia, and Africa, one in Australia, one (P. nudicaule L.) in boreal North America and south in the Rocky Mts. to New Mexico, and two in the Californias. (Latin name of the poppy.)

Juice milky; stigmas sessile and radiate upon the summit of the ovary.—Subgenus EUPAPAVER.
1. *P. californicum.*

Juice yellow; stigmas capitate upon the short slender style.—Subgenus MECONOPSIS.
2. *P. heterophyllum.*

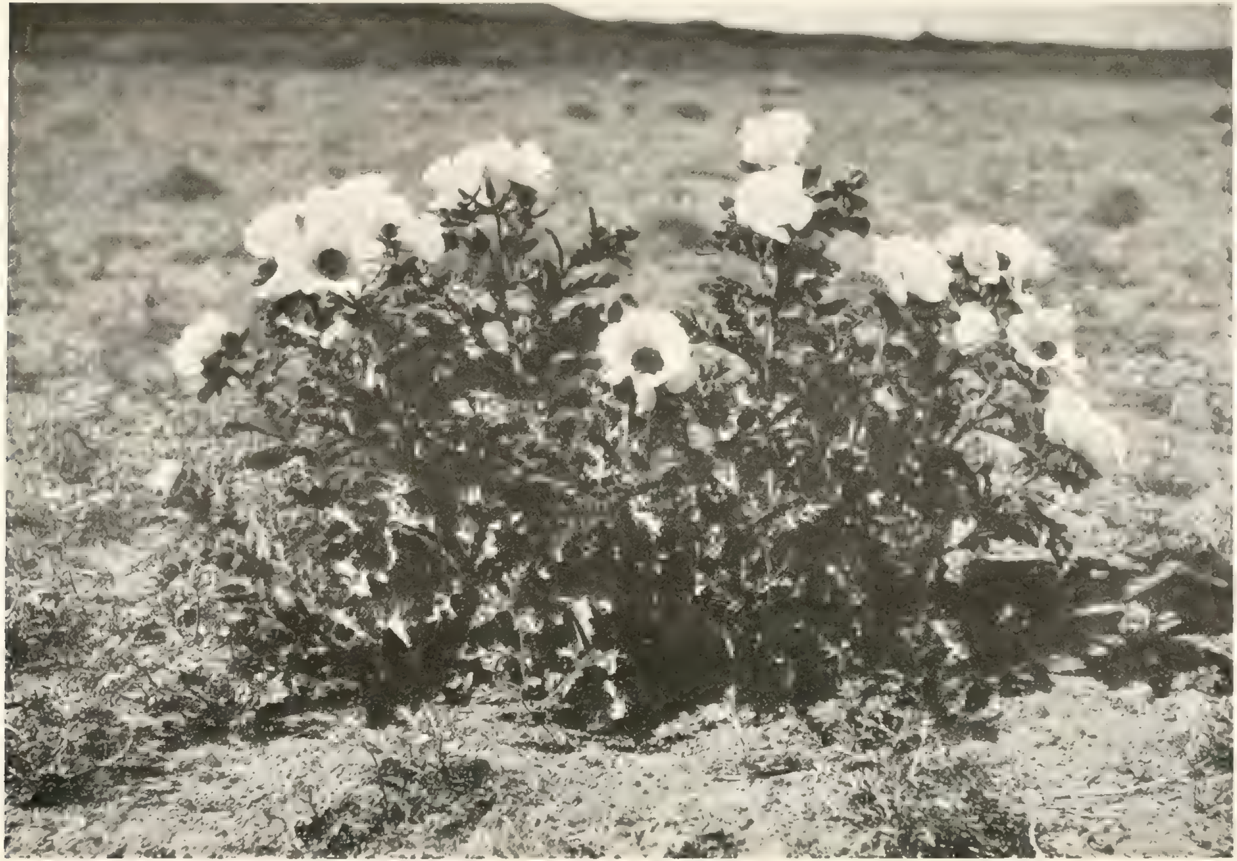

Fig. 116. ARGEMONE INTERMEDIA Sweet var. CORYMBOSA Eastw. Black's Ranch, southeast of Fremont Peak, Mohave Desert.
H. P. Chandler, photo.

1. **P. californicum** Gray. Western Poppy. (Fig. 117.) Glabrous or sparsely pilose-pubescent, 1½ to 2 feet high; juice milky; leaves pinnately divided, the segments oblong or roundish, toothed, lobed, or incised; petals red with a green spot at base, 7 to 10 lines long; stigmas sessile and radiate upon the summit of the ovary, forming a sort of "skull cap," persistent in fruit; capsule turbinate-obovate, 6 to 7 lines long.

Cismontane Southern California northward to Marin Co. Apr.-May.

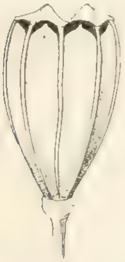

Fig. 117. Papaver californicum Gray; capsule, × 2.

Locs.—This species apparently occurs at but relatively few stations since it is infrequently collected. It is most common on burns the next year after a fire and on clearings. The following stations validate the indicated range: San Diego, *T. Brandegee;* Lakeside, San Diego Co., *T. Brandegee;* St. John's Cañon, s. of San Jacinto, *John Haslam;* San Dimas Cañon, San Gabriel Mts., *Peirson* 2397; Pasadena, *McClatchie;* Rattlesnake Cañon, Santa Barbara, *T. Brandegee;* San Marcos Pass, *T. Brandegee;* Santa Lucia Mts., *W. Vertriede;* Mt. Tamalpais, *Howe.*

Refs.—Papaver californicum Gray, Proc. Am. Acad. 22:313 (1887), type loc. Santa Inez Mts., *John Spence;* Jepson, Fl. W. Mid. Cal. 209 (1901). *P. lemmoni* Greene, Pitt. 1:168 (1888), type loc. Cholame Valley, San Luis Obispo Co., *Lemmon;* the "conical apiculation" is also more or less obvious in S. Cal. plants.

2. **P. heterophyllum** Greene. Wind Poppy. (Fig. 118.) Glabrous, 1½ to 2 feet high; juice yellow; leaves pinnate or pinnately divided, the segments entire, toothed or divided, exceedingly diverse in shape even on the same plant or the same leaf, varying from oval to narrowly linear; petals brick-red with a dark spot at base, broadly cuneate-obovate, ½ to 1 inch long; stigmas capitate at summit of a distinct and slender style; capsule clavate-obovoid, 4 to 7 lines long.

Hill slopes and valley fields: Coast Ranges from Lake Co. south to cismontane Southern California and Lower California; San Joaquin Valley; southern Sierra Nevada (Fresno Co. to Kern Co.). May.

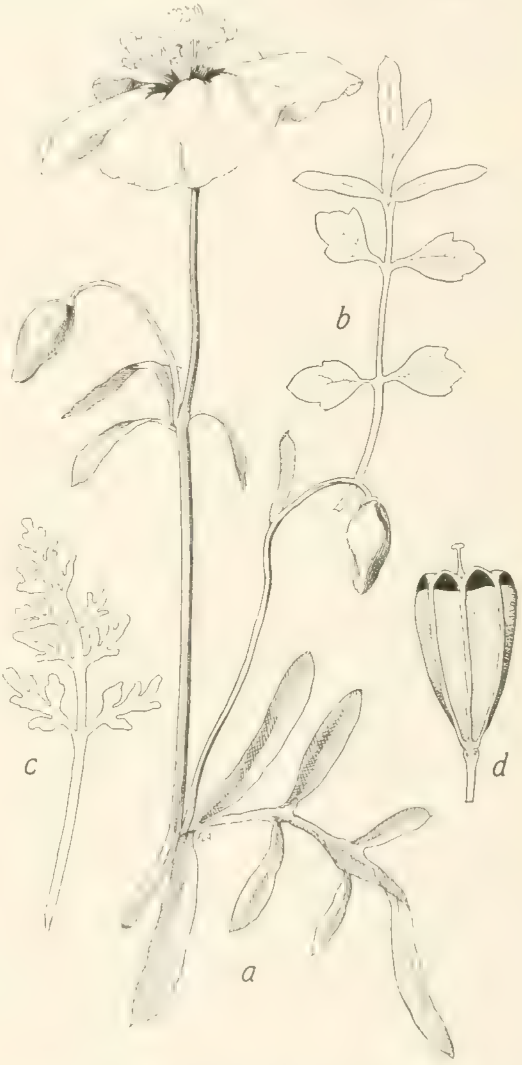

Fig. 118. Papaver heterophyllum Greene. *a*, habit, × 1; *b*, *c*, different leaf types, × ½; *d*, capsule, × 2.

Tax. note.—The petals are a sort of brick red, or better a deep apricot color, something like the flesh of a Moorpark, with the light green very short claws bordered above by a small purple spot. The calyx often falls away as a sort of calyptra, instead of as two separate sepals.

Locs.—Tracy, *Bioletti;* Martinez, *Drew;* Mt. Diablo, *Brewer* 1001 (we found this to correspond excellently, especially in leaf character, with the Douglas type at Kew); Wild Cat Creek, Berkeley Hills, *Jepson;* Pt. Isabel, Contra Costa Co., *Davy;* San Mateo Creek, San Mateo Co., *Davy* 1080; Livermore, *Jepson;* Mt. Hamilton, *Heller* 7436; Santa Cruz Mts., *T. Brandegee;* Paso Robles, *Barber* A18; Alcalde, *T. Brandegee;* betw. Dunlap and Pinehurst, Fresno Co., *Newlon* 145; Kaweah, *Hopping* 82; Springville, Tulare Co., *Purpus* 1304; Greenhorn Range, *Hall & Babcock* 5024; San Emigdio foothills (Zoe 4:145); San Bernardino, *Parish;* Box Springs Mt., Riverside, *Geo. R. Hall;* San Diego, *T. Brandegee.*

Refs.—PAPAVER HETEROPHYLLUM Greene, Pitt. 1:168 (1888); Jepson, Fl. W. Mid. Cal. 209 (1901). *Meconopsis heterophylla* Benth. Trans. Hort. Soc. Lond. ser. 2, 1:408 (1835), type grown from Cal. seed, *Douglas;* Hook. Ic. Pl. 8, t. 732 (1848); Brew. & Wats. Bot. Cal. 1:22 (1876). Var. CRASSIFOLIUM Jepson l.c. *Meconopsis crassifolia* Benth. l.c., type grown from Cal. seed, *Douglas,* a form with thicker leaves; the Douglas type at Kew we found to be almost exactly matched by a specimen from Tracy, San Joaquin Co. (Benj. Cobb.). *P. crassifolium* Greene, Man. Bay Reg. 9 (1894).

6. **ARCTOMECON** Torr. & Frem.

Herbs with a stout tap root. Leaves long-hirsute, crowded toward the base of the plant. Flowers large, white or yellow, solitary or in an umbelliform cluster. Sepals 2 or 3. Petals 4 or 6, round-obovate, in age persisting around the base of the capsule. Stamens numerous, short. Ovary and subcoriaceous capsule ovoid or obovoid, 3 to 6 (commonly 4)-valved; style shorter than the globular and lobulate mass of 3 to 6 erect and somewhat united stigmas. Seeds rather few, oblong.—Species 3, southwest United States. (Greek arctos, a bear, and mecon, poppy, from the hirsuteness.)

1. **A. merriamii** Cov. DESERT POPPY. Plants 1 foot high, the stems somewhat branched near the base; herbage glaucous; leaves mostly basal, cuneate-flabelliform, petiolate, coarsely toothed at apex, hirsute with long brown hairs, 3 to 7½ lines long, the cauline shorter; flowers 1½ to 2 inches broad, solitary on long naked peduncles; sepals 3, villous; petals 6, white; filaments slender, slightly dilated upwards; stigmas sessile.

Eastern Inyo Co. East to southern Nevada. Apr.

Locs. Ubehebe district, e. Inyo Co., *S. W. Austin* 437; Resting Springs Mine (Contrib. U. S. Nat. Herb. 4:59).

Refs.—ARCTOMECON MERRIAMII Cov. Proc. Biol. Soc. Wash. 7:66 (1892), type loc. Vegas Ranch, Lincoln Co., Nev., *Merriam & Bailey;* Contrib. U. S. Nat. Herb. 4:59, pl. 2 (1893). This species in its tufted habit, in the shape, size, toothing and hairiness of its leaves and in the size and fundamental structure of its flower is remarkably like A. californicum Torr. & Frem. Both species have been little collected. The differences in inflorescence and color seem well established but other presumed differences need further examination.

A. CALIFORNICUM Torr. & Frem.; Frem. Rep. Sec. Exped. 312, t. 2 (1845), type loc. Las Vegas, s. Nev., *Fremont;* Gray, Proc. Am. Acad. 12:53, pl. 2 (1876). Not thus far collected in Cal.; peduncles leafy-bracted, several to many-flowered; petals yellow; stigma sessile.

7. **ROMNEYA** Harv.

Tall glabrous perennial from a soft woody base, with colorless bitter juice and alternate pinnatifid leaves. Corolla very large, bright white, with frilled petals. Stamens very numerous. Ovary and coriaceous capsule with 7 to 12 plate-like placentae, some of which meet in the axis and form partitions. Style none. Stigmas 7 to 12, partly coherent in a ring.—Species 1. (The astronomer, T. Romney Robinson of Dublin, friend of Dr. Thos. Coulter, the discoverer of the plant.)

1. **R. coulteri** Harv. MATILIJA POPPY. (Fig. 119.) Stems branching, leafy, 3 to 8 feet high; herbage glabrous, glaucescent; leaves petiolate, pinnately parted

or divided into 3 to 9 cuneate-oblong to lanceolate divisions or leaflets, these sparingly dentate or the terminal one 3-cleft, the margins and rachis often sparsely spinulose-ciliate; flowers short-peduncled, terminal, not drooping in bud, delicately fragrant, lasting a few days; calyx glabrous, somewhat beaked; corolla 3 to 5 inches broad; capsule ovate to oblong, 1½ inches long, strigose-hispid, the 7 to 12 valves opening from the summit downward; seeds slightly incurved with dull roughish coat.

Washes and cañon beds, 1000 to 2500 feet, cismontane Southern California from Santa Barbara Co. to San Diego Co. Lower California. May-June.

Biol. Note.—This species propagates by suckers and thus forms dense stools or heavy clumps. It is often cultivated as an ornamental plant and does well in warm valleys behind an outer coast ridge, as in the Santa Clara Valley at Los Altos where it is beginning to be spontaneous in orchards and may require special control.

Locs.—Temescal Wash, *Jepson* 1571; Corona, *Hall* 568; Santa Ana Cañon near Anaheim, *Parish;* San Diego, *Mary Spencer* 139. Var. **trichocalyx** Jepson n. comb. Calyx setose, beakless or nearly so.—Range of the species.

Refs.—ROMNEYA COULTERI Harv.; Hook. Lond. Jour. Bot. 4:75, t. 3 (1845), type from Cal., *Coulter.* Var. TRICHOCALYX Jepson. *R. trichocalyx* Eastw. Proc. Cal. Acad. ser. 3, 1:133 (1898), based primarily on cult. plants.

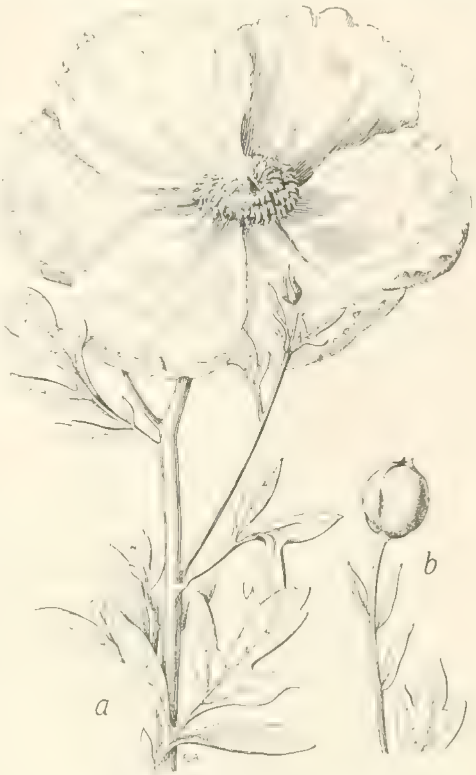

Fig. 119. ROMNEYA COULTERI Harv. *a*, flower; *b*, bud, × ½.

8. DENDROMECON Benth.

Glabrous evergreen shrub with alternate entire coriaceous leaves and golden yellow flowers. Sepals 2. Petals 4. Stamens numerous, with short filiform filaments and linear anthers. Style short, bearing 2 oblong stigmas. Capsule linear, curved, its two valves separating tardily or incompletely from the 2 thread-like placentae. Seeds pitted, provided with a caruncle.—Species 1. (Greek dendron, tree, and mecon, poppy.)

1. **D. rigida** Benth. BUSH POPPY. (Fig. 120.) Stems few to many from the base, 2 to 4 (or 8) feet high, the main stem bark shreddy; branches whitish; leaves yellowish green, oblong- to linear-lanceolate, reticulate, minutely denticulate, mucronate, 1 to 3½ inches long, borne on very short petioles which, by a twist, bring the blade vertical; flowers on peduncles 1 to 3 inches long; corolla 1 to 2½ inches in diameter; capsule 2 to 4 inches long.

Dry slopes and ridges at middle altitudes (1000 to 3000 feet): Coast Ranges; Sierra Nevada, north to Shasta Co. and southward to cismontane Southern California. May-June.

Ecol. Note.—The tap root is very stout, fleshy and brittle, and descends vertically for at least 3 to 5 feet. Regeneration takes place from the root crown, and there may be budding also from the roots, especially in areas of burned chaparral. A shrub in the Cajon Pass (*Jepson* 6110) showed flowers with 5 petals.

Locs.—Coast Ranges: Dunsmuir, *Jepson;* Mt. Tamalpais, *Jepson* 7453; Sommersville, Contra Costa Co., *Chesnut & Drew;* Mt. Diablo, *Jepson;* Moraga Ridge, *Jepson;* Santa Lucia Peak, *Jepson;* San Antonio Trail, Santa Lucia Mts., *Jepson.* Sierra Nevada: Yankee Hill, Columbia, *A. L. Grant* 669; Hazel Green to Bowers Cave, Mariposa Co., *Jepson;* Watson Spr., Sequoia Park, *Jepson.* Southern California: Rattlesnake Cañon, Santa Barbara, *Jepson* 9144; Ojai Valley, *Olive Thacher* 15; San Bernardino, *Parish;* Temecula Wash, *Jepson.*

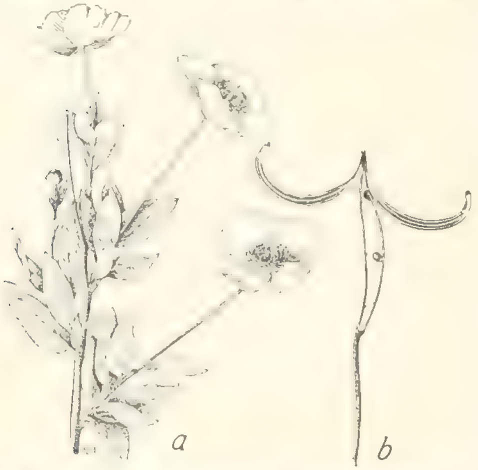

Fig. 120. DENDROMECON RIGIDA Benth. *a*, flowering branchlet; *b*. dehiscing capsule. × ½.

Var. **harfordii** K. Brandgee. Tree-like or shrubby, 6 to 10 (or 18) feet high, the branches more or less drooping; leaves elliptic, 1¼ to 5¼ inches long, entire, rarely minutely roughened.—Santa Barbara Isls.: Avalon, *Blanche Trask;* near Frey's Harbor, Santa Cruz Isl., *Frida Niedermüller;* Santa Rosa Isl., *Philip Mills Jones.*

Refs.—DENDROMECON RIGIDA Benth. Trans. Hort. Soc. ser. 2, 1:407 (1835), type grown from Cal. seed, *Douglas;* Jepson, Fl. W. Mid. Cal. 206 (1901). Var. HARFORDII K. Brandegee, Zoe 4:83 (1893). *D. harfordii* Kell., Proc. Cal. Acad. 5:102 (1873), type loc. Santa Rosa Isl., *W. G. Harford;* Trask, Erythea 7:145 (1899). *D. flexilis* Greene, Bull. Torr. Club 13:216 (1886), type loc. Santa Cruz Isl., *Greene.*

9. **ESCHSCHOLTZIA** Cham.

Annuals or perennials with watery juice, petioled ternately dissected leaves and peduncled yellow flowers. Receptacle hollowed or excavated, surrounding the base of the pistil, the calyx or corolla in consequence seeming as if perigynous; this receptacle (or torus) in addition often bears a spreading outer and an erect inner rim. Sepals completely united into a calyptra or pointed cap-like body which parts from the receptacle and is pushed off by the expanding petals. Stamens many, mostly on the base of the petals; anthers commonly longer than the filaments. Ovary linear; style very short; stigmas commonly 4, subulate-filiform, unequal. Capsule 1-celled, many-seeded, 2-valved.—Dehiscence of the capsule commonly occurs in flight, after the capsule parts from the receptacle and before it reaches the ground, usually beginning at the moment that the base of the capsule is released from the vise-like hollowed receptacle, this action allowing the valves which are elastically dehiscent from base to apex, to separate.—Species about 10. Oregon to New Mexico, California and northern Mexico. (Dr. J. F. Eschscholtz, college friend of Adelbert von Chamisso, German poet and naturalist, and his companion on Kotzebue's scientific voyage around the world.)

Cultural and field studies in Eschscholtzia.—Eschscholtzia is a genus which by the very unequal differentiation of its component species exhibits, like many other genera, very diverse specific values as they exist in nature. The true annuals consist of a number of species, which while not widely separated, are fairly constant in certain characters and recognizable as definite units of approximately equal status. The case is very different with the perennial forms. These comprise an aggregate, that is to say a central type with a number of more or less diverging forms, these diverging forms representing an endless complex of fluctuating and trivial variations in habit, vegetative organs, development of torus rim, form and size of calyptra, size and color of petals, number of stamens, number and relative size of stigmas, and rarely in the conditions of the cotyledons with respect to entirety, but all as now understood in the light of present investigations inevitably to be considered as a single species, since there are no two factors constantly associated. Examination and comparison of long series of specimens from the same locality and from different localities in all parts of California in connection with data derived from cultures and from experiments with hundreds of marked plants growing naturally prove satisfactorily that these variations may occur in endlessly varied and indefinite combinations.

The historic species is E. californica Cham., collected by Chamisso in the San Francisco sandhills in 1816. If a sandhill plant be followed through its flowering season, it exhibits in succession characters which have been used by two recent authors as differentiae for specific segregates. Much more striking are the results of field studies and experiments carried on during a period of eighteen years upon the form known as E. crocea Benth. This form reaches its highest development in the rich deep loams of interior valleys of California. When the rains break in October and November the plants develop tufts of leaves from the root-crown which continue to grow during the rainy season. In plants of a single colony and unquestionably of one species the foliage tufts exhibit severally various hues of green. In April these plants begin to flower. The flowering stems are stout, rigidly erect, leafy, or sometimes scapose, 1 to 2 feet high, bearing flowers with deep orange or copper-colored corollas 1½ to 2¼ inches long and exhibiting torus rims 1 to 2 lines wide (fig. 121). No other form equals this interior vernal one in size of corolla, width of torus rim, and gorgeousness of coloration. By the middle or end of April the rains cease, and as the weeks advance the successive flowering from the same individuals shows yellow-tipped petals or yellow corollas with a golden center. By the first or middle of May the summer heat of the rainless season begins, and the upright stalks cease to flower and begin to dry up. Their function is gradually assumed by stems from the same root-crowns, which give rise to the summer flowering. These stems are slender, ascending or diffuse, and bear flowers with straw-yellow corollas ½ to 1 inch long and torus rims ¼ to ½ line wide (fig. 122). Sometimes these same plants bear small golden corollas or more frequently yellow corollas with golden center. This flowering is characteristic of and continues through the arid or heat season until October. Hundreds of such plants growing in wild land have been carefully marked and connected with numbered iron stakes so that the individual could be positively identified in a succeeding month or season.

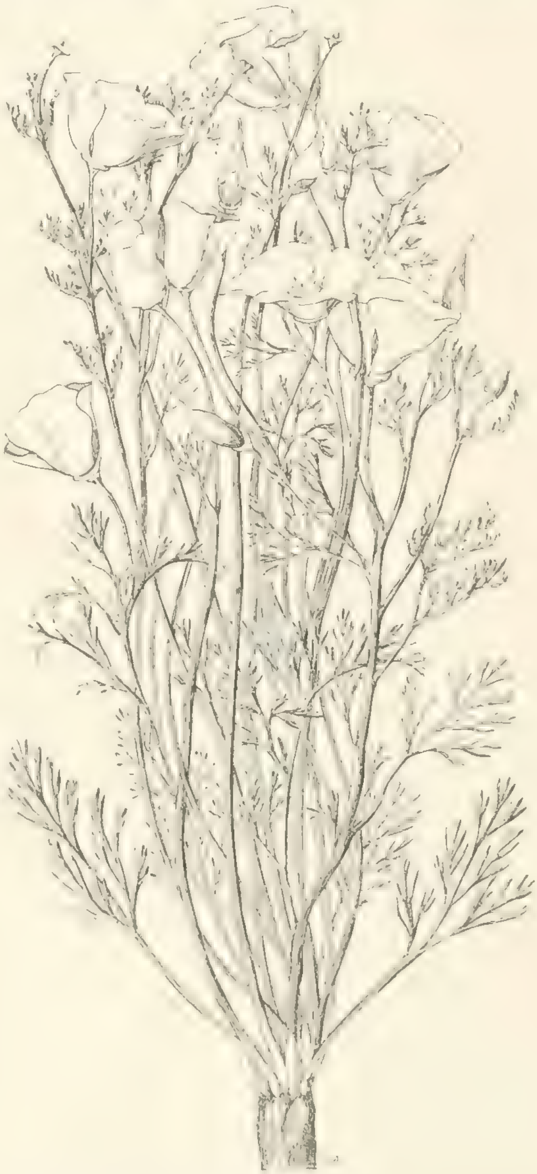

Fig. 121. ESCHSCHOLTZIA CALIFORNICA Cham. var. CROCEA Jepson. *E. crocea* Benth. This figure shows the habit of the plant at the vernal flowering stage in April. Observe the strictly erect stems, large corollas and broad torus rims. From this same root crown a crop of small flowers on slender diffuse stems is produced in summer and early fall. × ¼. Cf. Fig. 122. Also see p. 570.

Eschscholtzia californica is highly sensitive to rainfall, to humidity, to temperature and to the character of the soil. Individuals, for example, of the E. crocea form, after a given vernal flowering may not produce aestival flowers; sometimes the spring flowering of a given year represents the end of the reproductive period for that individual. On the other hand plants which have flowered during the summer period may not flower at all the next spring, or the next year, just as vernal flowering plants of a given year may not flower the spring of the next year. Plants grown on the coast at Berkeley from seed of the E. crocea form do not, in such a situation, go through the successive life-history phases which characterize that form in the interior valleys, but tend to simulate closely the coastal form. Transplantation of perennial Eschscholtzias is difficult, but we have made in early winter successful transplants of the E. crocea form from Vaca Valley in the interior to Berkeley on the coast. These individual plants on flowering the next spring resembled, not their Vaca Valley associates, nor indeed their own previous flowering, but the smaller flowered and often somewhat scapose plants of the Berkeley Hills!

The Eschscholtzia crocea form furnishes a characteristic illustration of variation in the perennial group. In this form extreme types of habit and of flowers are produced on one root-crown during one season's reproductive period. Specimens from one locality representing these different phases, have been described by two authors as species, and specimens of the different phases from various localities have also been described by the same authors as species. Such proposals obviously cannot stand as species. Our work upon the E. crocea form alone is sufficient to destroy the value of the characters used as differentiae in the diagnoses of the numerous segregates of E. californica made by Greene and by Fedde, for the reason that the normal range of variation in the successive flowering stages of this one form covers all the characters used by these authors in describing their segregates.

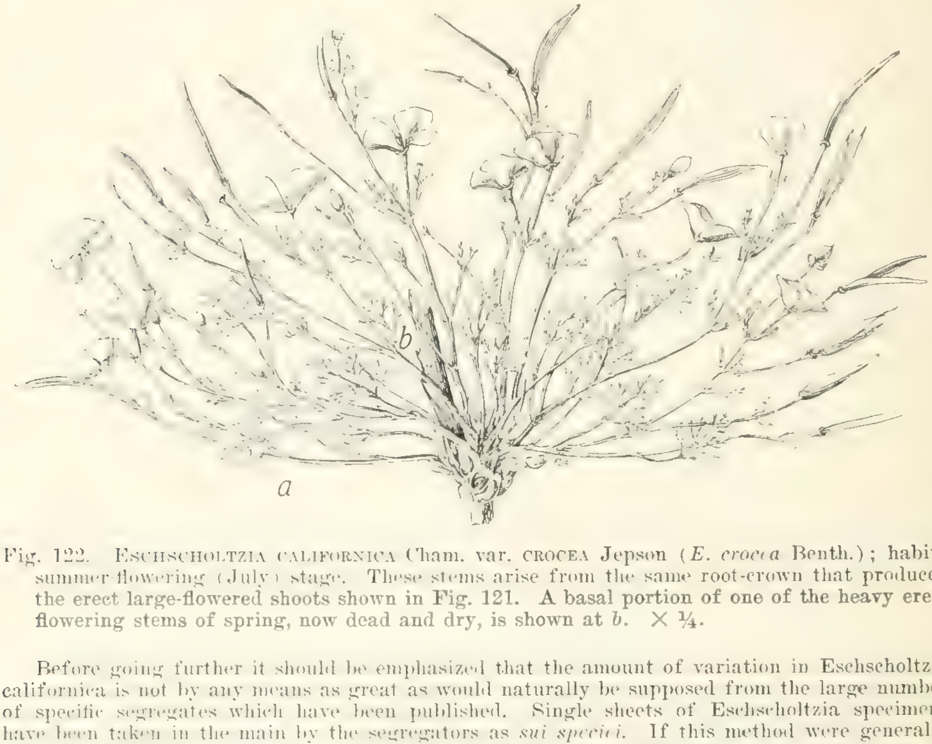

Fig. 122. ESCHSCHOLTZIA CALIFORNICA Cham. var. CROCEA Jepson (*E. crocea* Benth.); habit; summer-flowering (July) stage. These stems arise from the same root-crown that produced the erect large-flowered shoots shown in Fig. 121. A basal portion of one of the heavy erect flowering stems of spring, now dead and dry, is shown at *b*. × ¼.

Before going further it should be emphasized that the amount of variation in Eschscholtzia californica is not by any means as great as would naturally be supposed from the large number of specific segregates which have been published. Single sheets of Eschscholtzia specimens have been taken in the main by the segregators as *sui speciei*. If this method were generally employed it might be applied with similar results to hundreds of California species which have never been subject to segregation and which do not as yet possess a single synonym. We now proceed to a detailed analysis of the synonymy, although we regard the extent of our treatment as out of proportion to its intrinsic importance but not to its mass.

In Greene's Revision of Eschscholtzia (Pitt. 5:205–293) appear descriptions of 39 perennial species and 5 varieties, of which 32 species and all the varieties are new, 4 of the 7 remaining species having been fully described elsewhere by the same author. The annual species number 73 (or 1 a possible perennial) with 3 varieties, 56 of the species and the 3 varieties being new, 11 of the remaining 17 species having been previously described by Greene. Fedde in his account of Eschscholtzia (Engler, Pflzr. 4^{104}:144–202) follows Greene and accepts his species, with the addition, however, of several new species and varieties, reducing only one of Greene's species to varietal rank.

The primary division of the key in each of the above-mentioned accounts rests upon size and character of the torus rim, number of stamens, and condition of cotyledons, with respect to entirety. Secondary distinguishing characters, as set forth in the key, are mainly those relating to longevity, and to the vegetative parts and the two outer floral whorls (the two inner floral whorls receiving but brief mention even in the diagnostic accounts). In the present treatment an effort has been made to determine anew the actual value of these characters (*a*) by comparison of a large number of herbarium specimens from the same locality and from different localities, (*b*) by comparison of specimens taken from marked plants at different times of the year, (*c*) by application of the diagnoses of Greene and Fedde to the specimens quoted by them wherever these specimens were available, and (*d*) by the results of garden cultures.

1. Torus rim.—Characters of the torus rim, which is a conspicuous structure in the perennials, are not satisfactory as differentiae, since this organ shows marked variation in size and form. In the following specimens the flowers show variation in width of torus rim as indicated: Dinsmores Ranch, opp. Buck Mt., Humboldt Co., *Tracy* 4138 (½ to 1 line wide); Pt. Isabel, Contra Costa Co., *Davy*, Apr., 1897 (½ to 1 line wide); Twin Peaks, San Francisco, *K. Brandegee* 14e (¼ to ½ line wide); Palo Alto, *C. F. Baker* 43 (¼ to ½ line wide); Riverside, *Hall* 3713 (¾ to 1¼ lines wide); Chinese Camp, *Jepson* 6316 (⅛ to 6⁄8 line wide). The same specimens serve to show the increase in width of torus rim which often occurs with age, the mature fruits showing rims of greater width than the buds or flowers. The great variation in width of torus rim at different seasons of the year as shown by marked plants in natural colonies proves also that this character is subject to seasonal variation: Vaca Valley, *Jepson* 4721, 5163, 6276, 6278, 6791, 6846. It is further to be pointed out that variations in the torus rim are simply those of degree and do not involve any morphologic change in structure. An examination of the descriptions of the torus in Greene's Revision of Eschscholtzia shows certain discrepancies between the species characters as set forth in the diagnoses and the species characters as set forth in the key. We note the heading in the key, ‘‘Outer margin of torus not obscure, etc.’’ Under that heading we find certain species whose diagnoses contain a contrary or inconsistent statement as follows: *E. douglasii* Walp., ‘‘torus rim remarkably narrow and inconspicuous’’ (Pitt. 5:230); *E. shastensis* Greene, ‘‘torus exactly funnelform, the rim wholly inconspicuous, hardly surpassing the inner margin’’ (Pitt. 5:234); *E. diversiloba* Greene, ‘‘torus turbinate, its rim only small and insignificant’’ (Pitt. 5:256); *E. straminea* Greene, ‘‘torus very small, with rim greatly reduced, hardly more obvious than the inner margin’’ (Pitt. 5:257).

In the true annuals, however, the rimless torus is constant. The specimens we cite below under the several species verify this generalization.

2. Stamens.—In the great majority of perennial forms the number of stamens, about 24 to 44, is always indefinite. Greene's first key division is characterized by ‘‘Stamens mostly 40 or more.’’ In certain specimens, unquestionably perennial and therefore belonging under this first division, flowers are found bearing fewer stamens (as few as 16 to 27): Simpsons Ranch, Sweetwater Creek, Eldorado Co., *K. Brandegee* 23e; Mt. Vision, Marin Co., *Hall* 8510; clay hills north of Ocean View, *K. Brandegee* 15e; sand hills at Pt. Pinos, Monterey Co., *Heller* 6539. Certain specimens whose basal portion has not been preserved, but whose broad torus rim should place them in the group having ‘‘stamens mostly 40 or more’’ according to Greene's Revision of Eschscholtzia, are found to have in some flowers as few as 17 to 27 stamens: Bodega Head, *K. Brandegee* 10e, 11e; Salinas River near Castroville, Monterey Co., *K. Brandegee* 12e, 13e.

Also the following unnoted discrepancies occur in the ‘‘Revision’’ itself, that is, certain species falling under the first division ‘‘stamens mostly 40 or more’’ are described as having stamens fewer than 40: *E. bicornuta* Greene, ‘‘stamens few’’ (Pitt. 5:249); *E. ambigua* Greene, ‘‘stamens about 12’’ (Pitt. 5:251); *E. vernalis* Greene, ‘‘stamens about 16’’ (Pitt. 5:259); *E. peninsularis* Greene, ‘‘stamens definitely 8’’ (Pitt. 5:360). Under the division ‘‘Stamens fewer, in some definitely 16, 12, 8 or even 4,’’ occurs the species E. glyptosperma Greene. In this species we find as many as 27 stamens (Barstow, *K. Brandegee* 24e; Needles, *Ruby Warner*), a number greater than in any of the four segregates just noted which were included by Greene in his other section. Greene himself assigns ‘‘30 or more’’ stamens to this species (Pitt. 5:292). This character therefore does not by itself separate the genus into two distinct groups and is both too variable and too indefinite to be of real value.

3. Embryo.—Results obtained by the study of embryos as found in the seeds of a large number of herbarium specimens indicate that the condition of the cotyledons with respect to entirety, while not wholly invariable, is sufficiently so to render this character extremely valuable. From the following specimens, which are unquestionably perennial, data are obtained as recorded: Surf, *K. Brandegee* 7e (7 seeds examined, cotyledons all bifid); Surf, *K. Brandegee* 6e (10 seeds examined, 9 with cotyledons bifid, the remaining one with one cotyledon bifid, the other apparently entire); Seaside near Monterey, *K. Brandegee* 2e (6 seeds examined, cotyledons all bifid); Stanford, Santa Clara Co., *C. F. Baker* 174 (3 seeds examined, cotyledons

all bifid); Lake Merced, San Francisco, *Gardner* 526 (4 seeds examined, cotyledons bifid in 3, entire in 1); Presidio, San Francisco, *K. Brandegee* 20e (11 seeds examined, cotyledons bifid in 10, entire in 1); Twin Peaks, San Francisco, *K. Brandegee* 14e (9 seeds examined, cotyledons bifid in 8, entire in 1); Alma Soda Springs near the French settlement, Santa Clara Co., *Heller* 7501 = *E. granulata* Greene, Pitt. 5:235; *E. granulata* var. *minuscula* Fedde in Engler, Pflzr. 4^{104}:162 (9 seeds examined, cotyledons cleft in 5, entire in 4). On the other hand the members of the truly annual group are found to have entire cotyledons. Two to 4 seeds from many specimens were examined, these specimens being cited below under the species diagnoses and marked with an asterisk.

4. Longevity.—While all our Eschscholtzia forms fall into two distinct groups, annuals and perennials, the annual or perennial conditon taken alone is unsatisfactory as a character for practical use in classification, since the perennial forms flower the first year and their perennial nature is not at that time capable of proof. Moreover, particular individuals or colonies may, as a result of soil or seasonal conditions, perish the first year though potentially perennials under more favorable conditions. In the sum total of their characters they are allied to and belong with the perennial group. A very large number of diagnoses of so-called annual species have been drawn from single specimens which do not differ from the first-year form of known E. californica; they are therefore treated here as belonging to the perennial group. The perennial group, then, is commonly characterized by presence of a torus rim and by bifid cotyledons, while in the annual group the torus rim is absent and the cotyledons entire. Although these characters are not invariable in the perennial group they are sufficiently fundamental to be used in determining the primary sections of the genus.

Cotyledons 2-cleft; receptacle (torus) wth a collar-like rim; perennials (commonly flowering the first year)..........1. *E. californica.*
Cotyledons entire; receptacle (torus) without rim or with only a very narrow one; annuals.
  Stems more or less leafy.
    Petals 1 to 2⅔ lines long (longer in vars.); herbage usually glabrous; species of the Mohave and Colorado deserts ....2. *E. minutiflora.*
    Petals about ½ to 1 inch long; cismontane species.
      Herbage glabrous or nearly so.
        Stems stout; leaves very finely cut; insular species..........3. *E. elegans.*
        Stems slender; leaves not so finely cut; mainland species; var. hypecoides of 6. *E. caespitosa.*
      Herbage hoary-pubescent with curled white hairs..........4. *E. lemmonii.*
  Stems scapose, the leaves all in a low basal tuft or sometimes a few sub-basal.
    Seeds strongly muricate with flattened processes, i.e. bur-like; leaf divisions long and rather few..........5. *E. lobbii.*
    Seeds not muricate; leaf divisions numerous.
      Seeds smooth or reticulate; leaves in a moderately dense tuft, the petioles unequal. 6. *E. caespitosa.*
      Seeds with large deep rather remote pits; leaves in a very dense tuft, the petioles about equal..........7. *E. glyptosperma.*

1. **E. californica** Cham. California Poppy. Stems scapose or leafy, erect or diffuse, ¾ to 2 feet high; basal leaves ternately several times dissected into linear or oblong segments, on long or short petioles, the whole leaf ⅓ to 1 foot long; cauline smaller on short petioles; peduncles 2 or 3 to 6 inches long; petals fan-shaped, ½ to 2 inches long, varying from deep orange or copper-color to straw-color; outer spreading rim of the receptacle commonly ½ to 2 lines wide, the inner erect rim hyaline; capsule 1 to 3 or even 4 inches long.

Throughout cismontane California in the valleys and foothills, 10 to 2000 feet. Widely naturalized in Australia and India.

Note on Variability.—Fluctuating variability is so general and so wide-spread in Eschscholtzia californica that it is difficult to present an adequate account of it, but the following synopsis will help to give some hints of its extent and character.

1. Habit and leafiness.—The typical sand dune form is low and cespitose in habit, with thickened often multicipital caudex from which arises a cluster of small short-petioled leaves with short rather broad segments, and 1 to several short leafy (or mostly leafless and scapose) stems terminated by disproportionately large flowers: San Francisco, *Bioletti* in 1891; Twin Peaks, San Francisco, *K. Brandegee* 14e; clay hills north of Ocean View, *K. Brandegee* 15e; Lake Merced, San Francisco, *Gardner* 530. The following spms. from localities other than the type locality are essentially typical: Mt. Vision, Marin Co., *Hall* 8510; Oakland Hills, *Jepson* 6821; Pacific Grove, *Chandler* 320; Jolon, Monterey Co., *K. Brandegee* 20e; San Bernardino Valley, *Jepson* 5549; Beaumont, *Jepson* 6077; Warner Ranch, San Diego Co., *T. Brandegee*. There are continuous intergrades (Marine Hospital, San Francisco, *Heller* 6624) to plants with leafy stems and non-cespitose habit: Mt. Tamalpais, *K. Brandegee* 37e; Presidio, San Francisco, *C. F. Baker* 700; San Francisco, *C. F. Baker* 2999; Lake Merced, San

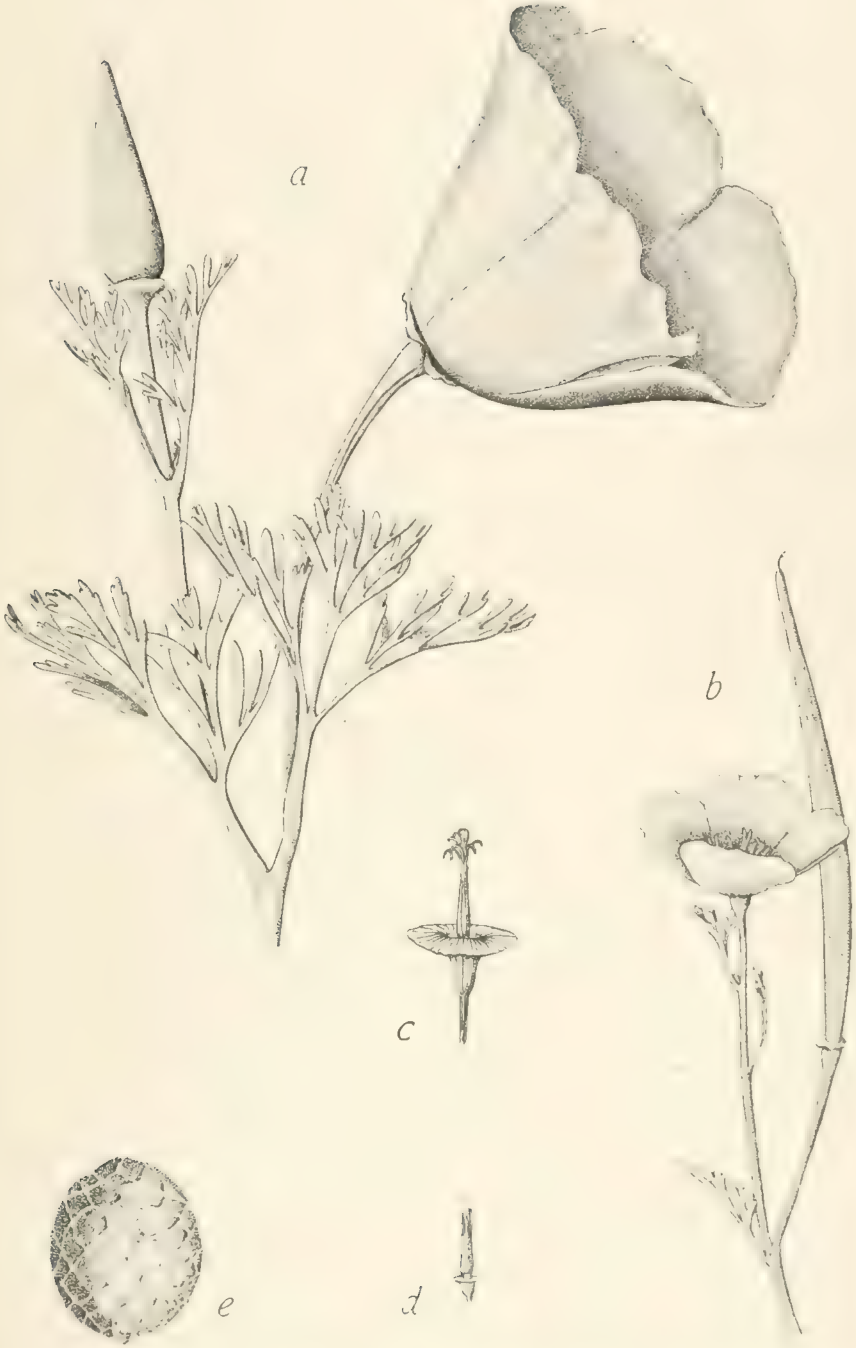

Fig. 123. Eschscholtzia californica Cham. var. crocea Jepson. The flowering branchlet *a* represents the average size of the large bronze-gold corollas of the spring flowering (Mar.-Apr.); these flowers are borne on stout erect stems. The flowering branchlet *b* was taken from the same root-crown as *a;* it represents the average size of the straw-yellow corollas of the summer and autumn flowering; such flowers are borne on slender diffuse stems. *c* is a detail of *a,* showing the characteristic broad torus rim of the spring flowering; *d* is a detail of *b*, showing the narrow torus rim of the summer flowering. Plants in full vigor which produce a crop of large flowers in spring produce also from the same root-crowns a regular crop of small summer flowers. *a, b, c, d,* × 1; *e*, seed, × 12.

Francisco, *Gardner* 526–531. These latter pass gradually into the form having erect branching leafy stems 1 to 1½ feet high with large golden yellow flowers (Lake Merced, San Francisco, *Gardner* 17e), which is indistinguishable from and culminates in the var. crocea, the common form further inland. In such a series there is no break and neither is any one character constantly associated with any other character. In some cases the stems are somewhat slender and ascending and but few in number (Cow Creek, Shasta Co., *Baker & Nutting* in 1894; Del Monte, Monterey Co., *Elmer* 3551), while in other cases they are stouter and stiffly erect, and numerous (near Walker Mt., Mendocino Co., *Davy* 1028 = var. crocea; near Copperopolis, Calaveras Co., *Davy* 1396 = var. crocea); the root, while often thickened above may lose its multicipital character (Cow Creek, Shasta Co., *Baker & Nutting* in 1894; Smith Sta., Yosemite Park, *Evans* 1; Poso Creek, Kern Co., *Hall & Babcock* 5008); the basal and often the cauline leaves may have long slender petioles and narrow elongated segments and the flowers long peduncles (Reche Cañon, San Bernardino, *Parish* 5607).

2. Glaucescence and pubescence.—Certain of the coast forms are not at all glaucescent (Pt. Isabel, Contra Costa Co., *Davy*, Apr. 1897; Alton, Humboldt Co., *Tracy* 3765). In other forms this character is sparingly evident (clay hills north of Ocean View, *K. Brandegee* 15e; Twin Peaks, San Francisco, *K. Brandegee* 14e; creek north of Mill Creek, Santa Lucia Mts., *Jepson* 2610); while the extreme is reached in the insular and mainland coast form, var. maritima Jepson (Surf, Santa Barbara Co., *K. Brandegee* 6e, 7e, 8e; Pt. Pinos, Monterey Co., *Heller* 6539; Seaside near Monterey, *K. Brandegee* 2e, 3e). Pubescence, if present at all, is itself variable in character, being rather fine in certain plants which answer to *E. foeniculacea* Greene (Salinas River near Castroville, *K. Brandegee* 12e, 13e) and of a scabrous nature in var. maritima Jepson (Surf, Santa Barbara Co., *K. Brandegee*, 8e, 9e).

3. Calyptra.—In typical E. californica (as figured by Chamisso) the calyptra is ovoid-conical, 7 lines long, with a stout blunt beak about 2 lines long. From this form, however, there is every intergrade to long slender beaks or short thick ones or even to nearly beakless calyptras. Even in one collection or even on one individual there are frequently found beaked and beakless calyptras: clay hills north of Ocean View, *K. Brandegee* 15e; Mt. Tamalpais, *K. Brandegee* 37e; Gold Run, Placer Co., *K. Brandegee* 38e; Tehachapi, *K. Brandegee* 39e.

4. Corolla.—In typical E. californica (as figured by Chamisso) the obovoid petals are 14 lines long. Specimens from the type locality vary considerably, the corolla in some plants being scarcely more than ½ inch long (Twin Peaks, San Francisco, *K. Brandegee* 14e), while in others it is 1½ to 1¾ inches long (San Francisco, *Bioletti* in 1891). The seasonal variation in size and color of the corolla in the var. crocea has been referred to above.

There is likewise a wide range of variation in color in plants from the type region of E. californica Cham. Plants with flowers of a very deep orange color are frequently found (clay hills north of Ocean View, *K. Brandegee* 15e; Lake Merced, San Francisco, *K. Brandegee* 17e), while plants of the following series by Gardner are alike not merely in technical characters but in habit and size, as alike indeed as if taken from the same root, and yet show the following color variation: vicinity of Lake Merced, San Francisco, *Gardner* 525, "petals clear light yellow, no evidence of orange"; 526, "clear light yellow except for orange spot in claw"; 527, "clear light yellow with definite deep orange blotch on lower third of each petal"; 528, "petals, lower half deep orange, upper half light yellow"; 529, "petals deep orange except for narrow fringe of light yellow"; and 531, "petals deep orange throughout." In occasional instances the petals are yellow tinged with red: Presidio (serpentine outcrop), San Francisco, *K. Brandegee*, May-June, 1908; Berkeley, *H. A. Walker* 201, *Jepson* June 21, 1905. In form and in number the petals are fairly constant, but there is occasionally a strong tendency to variation: Simpson's Ranch, Sweetwater Creek, Eldorado Co., *K. Brandegee*, June 1, 1908, "locality about 15 × 20 m., plants in close proximity" (petals truncate or rounded, entire or erose or with an abrupt tooth or scallop at tip, in some cases numbering 6, the inner 3 narrower than the outer); Sonoma Valley, *Jepson* 4188 (corolla often 6-merous).

5. Pistil.—The characters of the stigmas are scarcely used in either Greene's or Fedde's key as forming any part of their basis for distinguishing species, although *E. xylorrhiza* Greene, *E. scariosa* Greene, *E. gigas* Fedde and *E. chartacea* Fedde are described as having respectively 2, 8 or 10, many (12?), and 3 (or 6?) stigmas. In most of the other segregates the stigmas, if mentioned at all, are said to be "4 and unequal." The examination of herbarium material shows that there is a tendency toward variation from 4 stigmas but that this variation is not correlated with any other character: Presidio, San Francisco, *K. Brandegee* 20e, "styles 2–4 on same plant"; Berkeley (about vacant lots, Oxford and Center sts.), *K. Brandegee*, Nov., 1917; Grouse Creek, Humboldt Co., *Chesnut & Drew*, Aug. 1, 1888; New York Ravine, Eldorado Co., *K. Brandegee*, June, 1908; Parkfield, se. Monterey Co., *K. Brandegee*, May 12, 1916.

To sum up we find frequent evidence of fluctuating variability in a single collection or even on a single plant, examples of it being apparently as widespread as the species. It is conceivable and indeed probable that the descriptions of the segregates of Greene and of Fedde noted above, in each case resting upon a single specimen, may be but examples of inconstant variation.

The various lines of variation which we have discussed culminate in a few cases in strongly marked forms which for the sake of convenience are here described as if definite varieties although they represent only termini.

Var. **crocea** Jepson n. comb. (Figs. 121, 122, 123.) In its most marked form this variety passes normally through two seasonal flowering stages. (*a*) Vernal stage: stems commonly many from the crown of a thick deep-seated root, mostly stiffly erect, 1 to 1½ (or 2) feet high; herbage glaucous; stems leafy, or, in the ante-flowering stage, leaves in a basal tuft; flowers 1 or mostly 1½ to 2¼ inches long; buds 8 to 18 lines long, long-pointed; torus rim 1 to 2 lines broad; petals a deep rich orange; pods 2 to 3 inches long. (*b*) Aestival stage: stems fewer, diffuse, spreading or decumbent, ½ to 1 (or 1½) feet long, more or less branched, leafy; flowers ¼ to ½ (or 1) inch long; buds 2 to 3 lines long, apiculate; torus rim ⅛ to ¼ line broad; petals pale or straw-yellow; pods 1 to 1½ inches long.—Interior valleys, particularly the Sacramento and San Joaquin, reaching its highest development and most marked differentiation into two distinct flowering stages, vernal and aestival, when in rich alluvial loams. The above diagnosis of these two flowering stages is based primarily upon marked plants growing naturally in Vaca Valley (*Jepson* 4176, 4178, 4721, 6276, 6278, 6846).

Locs.—The specimens cited are referred here chiefly on the basis of morphological character. Coast Ranges: Scott Bar to Scott Valley, Siskiyou Co., *Jepson* 2956 (aestival); Horseshoe Bend, upper Sacramento River, *Jepson;* Bucksport, Humboldt Co., *Tracy* 3210 (vernal), 2118 (aestival); Hydesville, Humboldt Co., *Tracy* 3600; Walker Mt., Mendocino Co., *Davy & Blasdale* 1028 (vernal); Willits, *Jepson* 2501; Blue Lakes, Lake Co., *Jepson;* Coyote Valley, Lake Co., *Jepson;* Howell Mt., *Jepson* 2442 (aestival); Napa Valley, *Sonne* (vernal); Sonoma Valley, *Jepson* 4188 (vernal); Eldredge, Sonoma Co., *Jepson* 5800 (vernal); Vacaville, *Jepson* 4174, 4175, 4721, 5163, 6846 (aestival), and 4176, 4178, 4179, 4180, 6276, 6278, 6791 (vernal); Cordelia, Solano Co., *Jepson* 3080, 3083 (aestival); San Ramon Valley, *Jepson* 2643; San Leandro, *Jepson* 5299 (small-flowered, vernal); Niles, *Jepson* 2471 (vernal); Los Gatos, *Heller* 7285 (vernal) = *E. revoluta* Greene var. *caudatocalyx* Fedde in Engler, Pflzr. 4^{104}:172; Waltham Creek, San Carlos Range, *Jepson* 2657. Sierra Nevada: Upper Fall River Valley, *Jepson* 5767; Stillwater, Shasta Co., *Baker & Nutting* (aestival); Beckwith Pass, *Jepson* 7774; Indian Valley, Plumas Co., *Hall & Babcock* 4430 (aestival) = *E. shastensis* Greene acc. Fedde in Engler, Pflzr. 4^{104}:161; Chinese Camp, *Jepson* 6316; Wawona, *Hall* 9001 (aestival); Caliente, Kern Co., *Jepson* 6746 (leaf-segments broad and few); Keene, Tehachapi Mts., *Jepson* 7187. Great Valley: Marysville Buttes, *Jepson;* Clements, San Joaquin Co., *Jepson* 1821. Southern California: Beaumont, Riverside Co., *Jepson* 6077, *Hall* 5753 (vernal) = *E. sanctarum* Greene acc. Fedde in Engler, Pflzr. 4^{104}:168.

Var. **maritima** Jepson n. comb. Stems leafy, early ascending, later becoming prostrate, ½ to 1 foot long; herbage very glaucous, glabrous or minutely scaberulous or the pubescence often scurf-like; leaves with short crowded segments; calyptra of bud short-oblong, 4 to 5½ lines long, abruptly narrowed to a blunt or beaked apex; petals ¾ inch long, lemon yellow with an orange spot at base; pod 1½ to 2 inches long; seeds nearly smooth.—San Miguel Isl. and coast of Santa Barbara Co., north to Monterey Co. June-Sept.

Locs.—San Miguel Isl., *Greene* in 1887 (cult. at Berkeley from San Miguel seed); San Luis Obispo Co., *Summers*, June 17, 1884; Surf, Santa Barbara Co., *K. Brandegee* 5e, 6e, 7e, 8e, 9e; Pacific Grove, *Tidestrom*, June 6, 1893, *Chandler* 320; Seaside, Monterey Co., *K. Brandegee* 1e, 2e, 3e, 4e.

Var. **stricta** Jepson n. comb. Stems slender, branched, many from a branched taproot, ½ to 1 foot high; herbage glaucous, glabrous except for the scabrous-ciliolate petioles and petiolules; torus rim narrow, the inner margin of almost equal width; petals 3 lines long; stigmas 4 (or 2?); cotyledons bifid.—Snow Mt., Lake Co., *K. Brandegee*, Aug. 25, 1892 and June 22, 1891. Not at all well known and dubiously given varietal rank until better material is collected.

Other spms. before us, representing mostly slight departures from typical E. californica, but treated by Greene or Fedde as distinct from it are: San Diego, *Hall* 3975 (*E. clevelandii* Greene acc. Fedde in Engler, Pflzr. 4^{104}:173); Foster, San Diego Co., *Hall* 3873 (*E. vernalis* Greene acc. Fedde l.c. 180); San Diego, *C. F. Baker* 3387 (*E. clevelandii* Greene acc. Fedde l.c. 173); Riverside, *Hall* 3826 and 3713, also Moreno Valley, Riverside Co., *Hall* 3849 (*E. picta* Greene acc. Fedde l.c. 178); San Bernardino, *Parish* 4162 (*E. bernardina* Greene, Pitt. 5:255); San Bernardino, *Parish* 5770 (*E. picta* Greene acc. Fedde l.c.); City Creek, San Bernardino Mts., *Parish* 5722 (*E. straminea* Greene acc. Fedde l.c. 179); Reche Cañon, San Bernardino Co., *Parish* 5607 (*E. rigida* Greene acc. Fedde l.c. 170); Elysian Park, Los Angeles, *Braunton* 834 (*E. picta* Greene acc. Fedde l.c. 178); Palmdale, Antelope Valley, *Hall* 3046 (*E. picta* Greene acc. Fedde l.c.); Lockwood Valley, Mt. Pinos, Ventura Co., *Hall* 6441 (*E. absinthiifolia* Greene acc. Fedde l.c. 166); Santa Rosa Isl., *T. Brandegee*, June, 1888 (*E. robusta* Greene, Pitt. 5:256); Santa Cruz Isl., *Greene* in 1886 (*E. glauca* Greene, l.c. 266); Santa Barbara, *Bingham* in 1886 (*E. leptomatra* Greene, l.c. 265); Pt. Pinos, Monterey Co., *Heller* 6539 (*E. menziesiana* var. *coarctata* Fedde, Rep. Nov. Sp. 2:147); Pacific Grove, *Heller* 6638, 6860 (*E. helleriana*

Greene acc. Fedde in Engler, Pflzr. 4^{104}:160); Palo Alto, *C. F. Baker* 43 (*E. juncea* Greene acc. Fedde l.c. 158), late aestival form; Stanford, *C. F. Baker* 660 (*E. recta* Greene acc. Fedde l.c. 171); Stanford, *C. F. Baker* 174 (*E. granulata* Greene l.c. 235); above Alma Soda Springs near the French Settlement, Santa Clara Co., *Heller* 7501 (*E. granulata* Greene l.c.; *E. granulata* var. *minuscula* Fedde, Rep. Nov. Sp. 2:147), the spm. with cotyledons entire in some seeds, cleft in others; Tracy, *C. F. Baker* 2778 (*E. arvensis* Greene l.c. 253); Tracy, *C. F. Baker* 2906 (*E. arvensis* Greene acc. Fedde in Engler, Pflzr. 4^{104}:176); Berkeley, *Hall* 1091a (*E. revoluta* Greene acc. Fedde l.c. 172); Lake Merced, San Francisco, *Gardner* 526 (*E. pseudoinflata* Fedde, Rep. Nov. Sp. 3:75); Bodega Point, Sonoma Co., *Eastwood*, June 9, 1899 (*E. cucullata* Greene acc. Fedde in Engler, Pflzr. 4^{104}:157); Knoxville, Napa Co., *C. F. Baker* 2969 (doubtless a duplicate of Greene's type of *E. marcida* Greene l.c. 233); Kelseyville, Lake Co., *C. F. Baker* 3088 (*E. apiculata* Greene l.c. 235); Klamathon, Siskiyou Co., *Copeland* 3532 (*E. confinis* Greene l.c. 237); Shasta Valley, Siskiyou Co., *Hall & Babcock* 4082 (*E. confinis* Greene acc. Fedde l.c. 163); Fall River Sprs., Shasta Co., *Hall & Babcock* 4173 (*E. shastensis* Greene acc. Fedde l.c. 161); Cow Creek, Shasta Co., *Baker & Nutting* in 1894 (*E. recta* Greene l.c. 245); Amedee, Lassen Co., *Davy* in 1897 (*E. yainacensis* var. *modocensis* Fedde, Rep. Nov. Sp. 3:28); Mountain Sprs., Amador Co., *Hansen* 1059, and Irishtown, Amador Co., *Hansen* 1112 (*E. recta* Greene acc. Fedde in Engler, Pflzr. 4^{104}:171); Smith Sta., Yosemite Park, *H. M. Evans* 1 (*E. bioletti* Greene acc. Fedde l.c. 159); Madera, *Setchell*, Apr. 22, 1897 (*E. setchellii* Fedde, Rep. Nov. Sp. 3:183); Tulare, *Davy* 3101 (*E. inflata* Greene acc. Fedde in Engler, Pflzr. 4^{104}:183); Poso Creek, Greenhorn Range, Kern Co., *Hall & Babcock* 5008 (*E. recta* Greene acc. Fedde l.c. 171).

Teratology.—The plasticity of Eschscholtzia californica is evidenced by the number of cases of extreme variation or of abnormal structures which are reported each year. The corolla is sometimes 6-merous (Sonoma Valley, *Jepson* 4188) or with an inner whorl of linear petals (Berkeley, *Gray*); cf. also Erythea 7:81. Flowers with 1 or more slashed or lobed petals are often seen (Berkeley, *Pearl Edgerly*, *K. Brandegee*; Lake Merced, San Francisco, *K. Brandegee*). The stigmas are sometimes multiplied, becoming as many as 31 (San Francisco, *K. Brandegee*). Fasciated plants are reported nearly every year; these usually conform to one type—the whole of the stem parts being condensed into a single strap-shaped structure 8 to 12 inches high and 1½ inches wide, the summit bearing a monstrous flower, or sometimes with secondary fasciations bearing flowers (Stockton, *Audrey Lambourne*; cf. also Erythea 2:14 and 7:81).

Refs.—ESCHSCHOLTZIA CALIFORNICA Cham. in Nees, Hor. Phys. Ber. 73, t. 15 (1820), type loc. dry sterile sand, San Francisco, *Chamisso*; Fedde in Engler, Pflzr. 4^{104}:154, fig. 21^{1} (1909); var. *luxurians* Fedde, Rep. Nov. Sp. 3:27 (1906), type loc. Marine Hospital, San Francisco, *Heller* 6624. *E. absinthiifolia* Greene, Pitt. 5:239 (1905), type loc. Ventura Co., *Elmer* in 1902; Fedde in Engler, Pflzr. 4^{104}:166, fig. 22^{6} (1909). *E. ambigua* Greene, Fl. Fr. 286 (1892), type loc. Cholame, San Luis Obispo Co., *Lemmon*; Fedde l. c. 175, fig. 23^{1} (annual form). *E. angularis* Greene, Pitt. 5:238 (1905), type loc. Round Valley, Mendocino Co., *Chesnut* in 1897 and 1898; Fedde l.c. 164, fig. 22^{5}. *E. apiculata* Greene l.c. 235, type loc. Kelseyville, Lake Co., *C. F. Baker* 3088; Fedde l.c. 162, fig. 21^{18} (1909). *E. arvensis* Greene l.c. 253, type loc. Tracy, *C. F. Baker* 2778; Fedde l.c. 176, fig. 23^{3}; var. *dilatata* Greene l.c. type loc. Lathrop, *Greene*, Apr. 29, 1889 (annual form); var. *orthodichasialis* Fedde, Rep. Nov. Sp. 3:105 (1906) based on a garden spm. from Berkeley, *Hall* 3700. *E. benedicta* Greene l.c. 228, type locs. Lewis Creek, San Benito Co., and Cantua Creek, Fresno Co., *Eastwood*, May, 1893; Fedde in Engler, Pflzr. 4^{104}:158, fig. 21^{8}. *E. bernardina* Greene l.c. 255, type loc. Edgar Cañon, San Bernardino Mts., *Parish* 3139; Fedde l.c. 178, fig. 23^{5} (annual form); var. *coarctata* Fedde, Rep. Nov. Sp. 3:183 (1906), type loc. San Bernardino, *S. B. & W. F. Parish* 130. *E. bioletti* Greene l.c. 232, type loc. Hetch Hetchy, June, 1900, *Bioletti*. *E. brandegei* Greene l.c. 248, type loc. Lakeport, *Brandegee*, Apr., 1889; Fedde in Engler, Pflzr. 4^{104}:173, fig. 22^{22}. *E. calosperma* Greene l.c. 246, type loc. between Kings City and Jolon, Monterey Co., *Eastwood*, June 7, 1893. *E. chartacea* Fedde in Rep. Nov. Sp. 3:105 (1906), type loc. Colusa Co., *Brandegee*, Apr., 1889. *E. clevelandi* Greene l.c. 248, type loc. San Diego, *Eastwood*; Fedde in Engler, Pflzr. 4^{104}:173, fig. 22^{2} (1909). *E.* [illegible] Greene l.c. 252, type loc. Colusa Co., *T. Brandegee*, Apr., 1889 (annual form). *E. columbiana* Greene l.c. 231, type loc. lower Columbia River region, Wash. and Ore., *Suksdorf* in 1881; Fedde l.c. 159, fig. 21^{13} (1909). *E. compacta* Walp. Rep. 1:116 (1842). *Chryseis compacta* Lindl. Bot. Reg. t. 1948 (1837), type from the w. coast of N. Am. *Eschscholtzia confinis* Greene l.c. 237, type loc. Klamathon, *Copeland*, July 2, 1903; Fedde l.c. 163, fig. 22^{2}. *E. cucullata* Greene, Erythea 2:120 (1894), type loc. Ft. Bragg, Mendocino Co., *Michener* in 1893; Fedde l.c. 157, fig. 21^{1}. *E.* [illegible] Greene, Pitt. 5:263 (1905), type loc. Alcalde, Fresno Co., *T. Brandegee*. *E. debilis* Greene l.c. 227 (1905), type loc. Russian River sta., Sonoma Co., *Newell*, Aug., 1900. *E. diversiloba* Greene l.c. 256, type loc. Lakeport, *Brandegee*, Apr., 1889 (annual form). *E. douglasii* Walp. Rep. 1:116 (1842); Fedde l.c. 160, fig. 21^{12}. *Chryseis douglasii* H. & A. Bot. Beech. 320 (1840), type from Ore., *Douglas*; T. & G. Fl. 1:664 (1840). *E. eastwoodiae* Greene l.c. 227 (1905), type loc. Sequoia Mills, Fresno Co., *Eastwood*, May, 1893; Fedde l.c. 158, fig. 21^{5}.

E. foeniculacea Greene l.c. 224, type loc. Monterey and Castroville to La Honda, *T. & K. Brandegee*, Apr., 1889; Fedde l.c. 156, fig. 21^{4}. *E. floribunda* Greene l.c. 247, type loc. Santa Ysabel, *Henshaw*, May 15, 1893; Fedde l.c. 172, fig. 22^{19}; var. *gorgonica* Greene l.c., type loc. San Gorgonio Pass, *Leiberg*, Apr. 5, 1898; Fedde l.c. 173, fig. 22^{20}; var. *gracillima* Fedde in Rep. Nov. Sp. 3:105 (1906), type loc. Wildomar, Riverside Co., *Hall* 385; Fedde in Engler, Pflzr. 4^{104}:173; fig. 22^{21} (1909). *E. glauca* Greene, Pitt. 1:45 (1887), type loc. Santa Cruz Isl.; Fedde l.c. 157, fig. 21^{6}. *E. granulata* Greene, Pitt. 5:235 (1905), type loc. Stanford University, *C. F. Baker* 174; Fedde l.c. 162, fig. 21^{13}; var. *minuscula* Fedde in Rep. Nov. Sp. 2:147 (1906), type loc. Alma Soda Spr. near the French Settlement, Santa Clara Co., *Heller* 7501. *E. helleriana* Greene l.c. 229, type loc. Monterey, *Heller* 6860; Fedde in Engler, Pflzr. 4^{104}:160, fig. 21^{11} (1909); var. *tilingii* Fedde, Rep. Nov. Sp. 3:27 (1906), type loc. San Francisco, *Tiling*, 1874. *E. inflata* Greene l.c. 264, type loc. Goshen, Tulare Co., *T. Brandegee*, Apr. 2, 1891 (annual form); Fedde, in Engler, Pflzr. 183, fig. 23^{3} (1909). *E. isostigma* Greene l.c. 254, type loc. Montezuma Hills, *Jepson* in 1892 (annual form). *E. juncea* Greene l.c. 228, type loc. Santa Cruz Mts., *Parry* in 1888; Fedde l.c. 158, fig. 21^{9} (1909). *E. lacera* Greene l.c. 250, type loc. Kernville, *Palmer;* Fedde l.c. 175, fig. 22^{26} (annual form). *E. leptandra* Greene, Pitt. 1:170 (1888), type loc. Verdi, Nev., *Sonne;* Fedde l.c. 163, fig. 22^{1}. *E. leptomitra* Greene, Pitt. 5:265 (1905), type loc. Santa Barbara, *Bingham* in 1886. *E. leucosticta* Greene l.c. 229, type loc. Ben Lomond, Santa Cruz Co., *T. Brandegee* in June, 1889; Fedde l.c. 158, fig. 21^{10}. *E. macrantha* Greene l.c. 242, type loc. Visalia, *Patterson;* Fedde l.c. 168, fig. 22^{10}. *E. marcida* Greene l.c. 233, type loc. Knoxville, Napa Co., *C. F. Baker;* Fedde l.c. 160, fig. 21^{14}; var. *monticola* Greene l.c. type loc. Santa Lucia Mts., Monterey Co., *Eastwood;* Fedde l.c. fig. 21^{15}. *E. menziesiana* Greene l.c. 223, type loc. Pt. Pinos, Monterey, *Greene;* Fedde l.c. 155, fig. 21^{3} (1909); var. *recedens* Greene l.c. type loc. Pt. Pinos, Monterey; var. *anemophila* Greene l.c. type loc. Pt. Sur, *T. Brandegee;* var. *coarctata* Fedde, Rep. Nov. Sp. 2:148 (1906), type loc. Pt. Pinos, Monterey, *Heller* 6539; var. *nesiaca* Fedde l.c. type loc. Santa Cruz Isl., *Brandegee*, 1888. *E. microloba* Greene l.c. 250, type loc. Carrizo Plains, *Eastwood*, June 12, 1902; Fedde in Engler, Pflzr. 4^{104}:174, fig. 22^{25} (annual form). *E. nitrophila* Greene l.c. 240, type loc. Bear Valley, San Bernardino Mts., *Parish;* Fedde l.c. 166, fig. 22^{7}. *E. physodes* Greene l.c. 259, type loc. Witch Creek, San Diego Co., *Alderson* (placed here with doubt as no spms. seen). *E. picta* Greene l.c. 255, type loc. San Francisquito Cañon, Los Angeles Co., *Parish;* Fedde l.c. 178, fig. 23^{4} (annual form). *E. procera* Greene l.c. 241, type loc. Kernville, *T. Brandegee*. *E. pseudoinflata* Fedde, Rep. Nov. Sp. 3:75 (1906), type loc. Lake Merced, San Francisco, *Gardner* 526. *E. recta* Greene l.c. 245, type loc. Elmira, *Baker* 2921; Fedde in Engler, Pflzr. 4^{104}:171, fig. 22^{15}. *E. revoluta* Greene l.c. 247, type loc. Livermore Valley, *Greene*, Apr. 3, 1895; Fedde l.c. 172, fig. 22^{17}; var. *caudatocalyx* Fedde in Rep. Nov. Sp. 3:105 (1906), type loc. Niles, *Hall* 1637; Fedde in Engler, Pflzr. 4^{104}:172, fig. 22^{18}. *E. rigida* Greene l.c. 244, type loc. Tehachapi, *Greene;* Fedde l.c. 170, fig. 22^{14}. *E. robusta* Greene l.c. 266, type loc. Santa Rosa Isl., *T. Brandegee;* Fedde l.c. 185, fig. 23^{11} (annual form). *E. sanctarum* Greene l.c. 243, type loc. Mesa Grande, San Diego Co.; Fedde l.c. 168, fig. 22^{11}. *E. scariosa* Greene l.c. type loc. Carrizo Plains, *Eastwood;* Fedde l.c. 169, fig. 22^{13}; var. *dichasiophora* Fedde, Rep. Nov. Sp. 3:75 (1906), type loc. Cuyama, Caliente Creek, San Luis Obispo Co., *Eastwood*. *E. setchellii* Fedde in Engler, Pflzr. 4^{104}:183, type loc. Madera, *Setchell* (annual form). *E. shastensis* Greene l.c. 234, type loc. Stillwater, Shasta Co., *Baker & Nutting*, May 21, 1894; Fedde l.c. 161, fig. 21^{16} (1909). *E. straminea* Greene l.c. 257, type loc. San Bernardino Mts., *Parish;* Fedde l.c. 179, fig. 23^{6} (annual form). *E. tenuisecta* Greene, Pitt. 1:169 (1888), type loc. Chico, *Parry;* Fedde l.c. 176, fig. 23^{2} (annual form). *E. thermophila* Greene, Pitt. 5:256 (1905), type loc. upper San Joaquin, *T. Brandegee* (annual form). *E. tristis* Fedde l.c. 170, type loc. Temecula, *Hall* 1978. *E. vernalis* Greene l.c. 258, type loc. Los Angeles and San Diego cos. *E. yainacensis* Greene l.c. 234, based on Yainax Indian Reservation, Ore., *R. M. Austin*, and Modoc Co., *M. S. Baker;* Fedde l.c. 161, fig. 21^{17}; var. *modocensis* Fedde, Rep. Nov. Sp. 3:28 (1906), type loc. Modoc Co., *M. S. Baker*, June, 1893. Var. CROCEA Jepson. *E. crocea* Benth. Trans. Hort. Soc. ser. 2, 1:407 (1835), type a garden plant (Cal. seed, *Douglas*); Fedde in Engler, Pflzr. 4^{104}:167, fig. 22^{8}. Var. *longissima* Greene l.c. 241, type loc. Colusa Co., *T. Brandegee;* Fedde l.c. 168, fig. 22^{9}. Var. *apiifolia* Greene l.c., type loc. Vacaville, *Jepson*. Var. MARITIMA Jepson. *E. maritima* Greene, Pitt. 1:60 (1887), type loc. Pt. Harris, San Miguel Isl., *Greene;* T. Brandegee, Zoe 5:175 (1903), under E. californica; Fedde in Engler, Pflzr. 4^{104}:155, fig. 21^{2} (1909). Var. STRICTA Jepson. *E. stricta* Greene, Pitt. 5:236 (1905), type loc. Snow Mt., Lake Co., *T. Brandegee*, June 22, 1891. *E. xylorrhiza* Greene l.c. 238, type loc. Snow Mt., Lake Co., *Brandegee*, Aug. 25, 1893; Fedde l.c. 164, fig. 22^{4}.

2. **E. minutiflora** Wats. Stems several to many, branching, leafy and floriferous, 2 to 12 inches high, from a slender sometimes branched taproot; herbage glabrous (rarely pubescent), often glaucous; flowers on slender peduncles little or not at all exceeding the foliage; torus tubular-campanulate, the rim not expanded but often obscurely fluted, a hyaline internal edge commonly a little projecting; petals 1 to 2⅔ lines long; seeds spherical or nearly so, reticulate.

Colorado and Mohave deserts, the bordering ranges, and north to Inyo Co.; east to Utah and Arizona. Apr.-June.

Locs.—Bishop Creek, Inyo Co., *Hall & Chandler* 7237; Pleasant Cañon, Panamint Mts., *Hall & Chandler;* *Barnwell, *K. Brandegee;* *Randsburg, *K. Brandegee* 34e; Daggett, *Jepson* 5846; Barstow, *Jepson* 5808; Stoddard's Well, *Jepson* 5917; Shay's Well (w. of Warren's Well), *Jepson* 5953; Palm Sprs., Mt. San Jacinto, *Parish* 4106; San Felipe Gap, *T. Brandegee* 1e; Vallecito, *Jepson & Dutton* 8911.

The following spms., which we have examined and determined as E. minutiflora Wats., have been segregated by Greene or Fedde as indicated: Pah Ute Peak, Kern Co., *Purpus* 5107 (*E. petrophila* Greene acc. Fedde in Engler, Pflzr. 4^{104}:196); Erskine Creek, Kern Co., *Purpus* 5324 (*E. minuscula* Greene acc. Fedde l.c. 188); Manzana, Antelope Valley, *Davy* 2489 (*E. modesta* Greene acc. Fedde l.c. 191); Ells, Leonis Valley, w. Mohave Desert, *Davy* 2593 (*E. multicaulis* Fedde acc. Fedde in Engler, Pflzr. 4^{104}:191), robust, diffusely much branched, perennial acc. Fedde, but the perennial character not apparent; *Alpine, Los Angeles Co., *Parish* 1951 (*E. modesta* Greene acc. Fedde l.c. 191); Mohave Desert, *N. C. Wilson*, June 14, 1893 (*E. micrantha* Greeno acc. Fedde l.c. 192); *Bagdad, Mohave Desert, *Hall* 6081 (*E. micrantha* Greene acc. Fedde l.c.); Coyote Cañon, Colorado Desert, *Hall* 2781 (*E. micrantha* Greene acc. Fedde l.c.); Santa Maria Mts., *Schellenger*, Apr., 1905 (*E. micrantha* Greene acc. Fedde l.c.).

Var. **parishii** Jepson n. comb. Petals 4 to 6 (or 7) lines long.—Colorado Desert: San Felipe Gap, *T. Brandegee* 2e; *Colorado Desert, *T. Brandegee;* Mason's, Mason Valley, *K. Brandegee;* *Chuckawalla Sprs., *Hall* 5898. The following with petals 3 to 4 lines long are intergrades between the species and var. parishii: Panamint Mts., *Jepson* 7117 (Emigrant Cañon), 7055, 7067 (Hanaupah Cañon); Nelson Range, Inyo Co., *S. W. Austin;* Blue Mt., Greenhorn Range, *Hall & Babcock* 5006; Whitewater, e. of San Gorgonio Pass, *Parish* 6103. Var. **rutaefolia** Jepson n. comb. Stems slender, many from the base; leaves ternate or biternate, the lobes broadly cuneiform.—Havilah, Kern Co., *T. Brandegee*, May 15, 1891.

Refs.—ESCHSCHOLTZIA MINUTIFLORA Wats. Proc. Am. Acad. 11:122 (1876), type loc. nw. Nev. to Ariz. and s. Utah, *Parry;* Fedde in Engler, Pflzr. 4^{104}:194, fig. 24^{17} (1909). *E. covillei* Greene, Pitt. 5:275 (1905), type loc. Death Valley region, Inyo Co., *Coville & Funston* 334; Fedde l.c. 192, fig. 24^{12}. *E. micrantha* Greene l.c. 277, type loc. Mohave Desert, *Curran;* Fedde l.c. fig. 24^{12}; var. *fusigemmata* Fedde, Rep. Nov. Sp. 3:184 (1906), type loc. Palm Sprs., *Selman* in 1902; Fedde in Engler, Pflzr. 4^{104}:192, fig. 24^{15} (1909). *E. minuscula* Greene l.c. 270, type loc. Hawthorn, Nev., *M. E. Jones;* Fedde l.c. 188, fig. 24^{5}. *E. modesta* Greene, Pitt. 1:169 (1888), type loc. Los Angeles Co., *Parish* 1951; Fedde l.c. 191, fig. 24^{13}. *E. multicaulis* Fedde, Rep. Nov. Sp. 2:145 (1906), type loc. Leonis Valley, Los Angeles Co., *Davy* 2593; Fedde in Engler, Pflzr. 4^{104}:191, fig. 24^{11} (1909). *E. petrophila* Greene, Pitt. 5:283 (1905), type loc. Pah Ute Peak, Kern Co., *Purpus*. *E. pusilla* Greene l.c. 281, type loc. Kernville, Kern Co., *T. Brandegee*, May 13, 1891. *E. tortuosa* Greene l.c. 278, type loc. Byrne's Spr., ne. San Bernardino Mts., *Parish* in 1894; Fedde l.c. 193, fig. 24^{16}. Var. PARISHII Jepson. *E. parishii* Greene, Bull. Cal. Acad. 1:183 (1885), type loc. Colorado Desert, *Parish;* Fedde in Engler, Pflzr. 4^{104}:187, fig. 24^{3}. Var. RUTAEFOLIA Jepson. *E. rutaefolia* Greene, Pitt. 5:271 (1905), type loc. Havilah, Kern Co., *Brandegee*, Apr. 15, 1891; Fedde l.c. 188, fig. 24^{6}.

3. **E. elegans** Greene. Stout leafy-stemmed annual, much branched above the base, 1 foot high; herbage glaucous, glabrous or slightly scabrous; leaves very finely cut; torus narrow-campanulate, the scarious inner ring conspicuous; corolla ½ inch long; mature seeds reticulate.

Santa Barbara Islands. Apr.-May.

Locs.—Santa Cruz Isl., *T. Brandegee;* Santa Catalina Isl., *K. Brandegee*, May, 1889 (in part), *Geo. B. Grant* 3777 (in part); Pebbly Beach, Catalina Isl., *Reed* 2842.

Refs.—ESCHSCHOLTZIA ELEGANS Greene, Bull. Cal. Acad. 1:182 (1885), type loc. Guadalupe Isl.; Fedde in Engler, Pflzr. 4^{104}:187, fig. 24^{2} (1909). Var. *ramosa* Greene l.c., type loc. Guadalupe Isl. *E. ramosa* Greene, Bull. Torr. Club 13:217 (1886); Fedde l.c. 185, fig. 24^{1}. *E. trichophylla* Greene, Pitt. 5:268 (1905), type loc. Santa Cruz Isl., *T. Brandegee*, Apr., 1888. *E. crossophylla* Greene l.c. type loc. Santa Catalina Isl., *T. Brandegee*, May, 1889.

4. **E. lemmonii** Greene. Stems usually somewhat leafy, branching, 6 to 12 inches high; herbage more or less pubescent with white hairs; torus urn-shaped, glabrous, 3 to 4 lines long; calyptra white-pubescent; petals orange, ½ to 1 inch long; capsule 1¼ to 2½ inches long.

San Carlos Range, south through inner San Luis Obispo Co. May-June.

Locs.—*Alcalde, *Eastwood*, May 10, 1893, *T. Brandegee* in 1891. Var. **asprella** Jepson n. comb. Buds lightly pubescent to quite glabrous.- Plaskett Ranch, Kings City, *K. Brandegee* 33e; Waltham Creek, San Carlos Range, *Jepson* 2660.

Refs.—ESCHSCHOLTZIA LEMMONII Greene, W. Am. Sci. 3:157 (1887), type loc. Cholame, San Luis Obispo Co., *Lemmon* in 1887; Fedde in Engler, Pflzr. 199, fig. 24^{30} (1909). Var. *laxa* Greene, Pitt. 5:289 (1905), type loc. Alcalde, Fresno Co., *Eastwood*, May 10, 1893. Var. *cuspidata* Greene l.c. type loc. San Luis Obispo, *Jared* in 1893. *E. eximia* Greene l.c. 273, based on Zapato, Fresno Co., *T. Brandegee*, Mar. 27, 1893, and Alcalde, *T. Brandegee*, Mar. 30, 1893. *E. alcicornis* Greene l.c. 273, type loc. Alcalde, *T. Brandegee* in 1891; Fedde l.c. 190, fig. 24^{9}. *E. delitescens* Fedde l.c. 200 (1909), type loc. Alcalde, *T. Brandegee* in 1891. *E. urceolata* Eastw. Bull. Torr. Club 30:488 (1903), type loc. hills betw. Cuyama Valley and Carrizo Plains. Var. ASPRELLA Jepson. *E. asprella* Greene l.c. 272, type loc. San Miguelito Rancho, Monterey Co., *Eastwood*, May, 1897; Fedde l.c., 189, fig. 24^{8}.

5. **E. lobbii** Greene. (Fig. 124.) Scapose, 4 to 8 (or 11) inches high, the leaves in a basal or sub-basal tuft with comparatively few linear or linear-lanceolate to almost filiform divisions; petals light yellow, 3 to 6 lines long; seeds strongly muricate with flattened processes, i,e., bur-like.

Sterile gravelly or clay foothills and rolling valley plains, 1000 to 2000 ft.: Sierra Nevada foothills; foothills of inner North Coast Ranges and the Sacramento Valley. Mar.-Apr.

Locs.—Sacramento Valley: *Redding, *Nutting, M. S. Baker* 4; Manzanita Flat betw. South Fork Cottonwood Creek and Dibble Creek, Tehama Co., *Jepson;* Chico, *R. M. Austin* 93; *College City, Colusa Co., *Alice King;* *Marysville Buttes, *Heller* 7575; *Willow Branch, Sutter Co., *Jepson;* Violet sta., Solano Co., *Jepson;* Peaceful Glen Valley, nw. Solano Co., *Jepson.* Sierra Nevada foothills: Simpson Ranch, Sweetwater Creek, Eldorado Co., *K. Brandegee* 32e (processes on seeds farther apart and less pronounced); *Layne Ranch near Pilot Hill, Eldorado Co., *K. Brandegee* 31e; Folsom, *K. Brandegee;* Milton, Calaveras Co., *Davy* 1223; Table Mt., near Sonora, *Jepson* 6424; Linden, San Joaquin Co., *Gunnison;* Grapevine Spr., e. of Visalia, *Woolsey;* Lemon Cove, *Hopping;* Kaweah, *Hopping* 261; Middle Tule River, *Purpus* 5005 (*E. pulchella* Greene acc. Fedde in Engler, Pflzr. 4^{104}:201).

Refs.—ESCHSCHOLTZIA LOBBII Greene, Pitt. 5:290 (1905), type loc. nw. Solano Co., *Jepson;* Fedde in Engler, Pflzr. 4^{104}:200, fig. 24^{31} (1909). *E. tenuifolia* Hook. Bot. Mag. t. 4812 (1854), type an English garden plant (Veitch), undoubtedly from Cal. seed collected by Lobb; not *E. tenuifolia* Benth. *E. graminea* Fedde, Rep. Nov. Sp. 2:146 (1906), type loc. Table Mt., Plumas Co., *M. E. P. Ames* in 1867 (doubtfully placed here, no spms. seen). *E. pulchella* Greene l.c. 291, type loc. lowest foothills of n. Sierra Nevada; Fedde in Engler, Pflzr. 4^{104}.201, $24^{32,\ 33}$. *E. unguiculata* Greene l.c. 292, type loc. Madera, *Buckminster.*

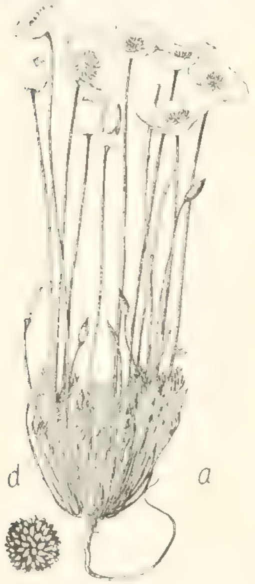

Fig. 124. ESCHSCHOLTZIA LOBBII Greene. *a*, habit, × 3/8; *b*, seed, × 5.

6. **E. caespitosa** Benth. Stems usually scapose, several to many from a tuft of basal leaves, 3 to 9 inches high, far exceeding the leaves; herbage glaucous, glabrous or below somewhat hispidulous; leaves cut into rather numerous narrow lobes; torus turbinate to oblong-turbinate; petals pure yellow, ½ to 1 inch long; seeds longer than broad, abruptly acute, lightly reticulate or almost smooth.

South Coast Ranges, south to Los Angeles Co. Apr.-May.

Locs.—Monrovia, Los Angeles Co., *C. F. Baker* 4180; Mono Creek, Santa Barbara, *Hall* 7821; Santa Inez Mts., *T. Brandegee.*

Var. **rhombipetala** Jepson n. comb. Similar in habit but the scapes hardly exceeding the leaves; torus usually about twice as long as broad; petals fugacious; seeds reticulate-pitted.—Foothills and plains at east base of the Mt. Diablo Range (Byron, *Greene*).

Var. **hypecoides** Gray. Stems slender, leafy, somewhat branched, 3 to 12 (or 18) inches high; petals ⅓ to 1 inch long; seeds spherical or slightly elongate.—Fertile hillslopes: Sierra Nevada foothills from Kern Co. to Butte Co., about 1200 to 2500 ft.; Coast Ranges from Trinity Co. to Monterey Co., 100 to 2000 ft.

Locs.—Sierra Nevada: Kaweah, *Hopping* 81; Grapevine Sprs., e. of Visalia, *Woolsey,* Mar. 20, 1898; Dunlap, Fresno Co., *Jepson* 2761; ridge n. of Pinehurst, Fresno Co., *Newlon* 200 (fls. very deep orange); Knights Ferry, *Bancroft;* Duck Bar, Tuolumne River, *A. L. Grant* 714; Stanislaus River road near Parrott's Ferry, *A. L. Grant;* Jackson, Amador Co., *Hansen* 81; *Sweetwater Creek, Eldorado Co., *K. Brandegee* 25e, 26e; *Folsom to Placerville near

Indian Creek, *K. Brandegee* 27e; *Auburn, *K. Brandegee* 28e; South Peak, Marysville Buttes, *Jepson*, Apr. 20, 1891; Little Chico Creek, *R. M. Austin* 94. Coast Ranges: Ruth, Trinity Co., *Tracy* 4326 (very glaucous); Alder Sprs., Glenn Co., *Heller* 11440; betw. Lakeport and Hopland, *C. F. Baker* 3094 (*E. bakeri* Greene, Pitt. 5:284); Scotts Valley, Lake Co., *Tracy* 1865; Yolo Mts., *C. F. Baker* 2995 (*E. dumetorum* Greene l.c.); Mt. St. Helena, *C. F. Baker* 2614 (*E. formosa* Greene l.c. 288; Fedde in Engler, Pflzr. 4^{104}:198); Pope Valley grade from Calistoga, *Jepson*, May 2, 1893; Wooden Valley grade, Napa Range, *Jepson*, Apr. 28, 1893 (this specimen was compared by us with the type of *E. hypecoides* Benth. at the Herbarium of the Royal Botanic Gardens at Kew; it is plainly the equivalent of Bentham's type. It is also, however, a good match for the type of E. caespitosa Benth. in its flowers, buds and torus); Miller Cañon, Vaca Mts., *Jepson*; Gates Cañon, Vaca Mts., *Jepson* in 1892 (compared by us with the type of *E. hypecoides* Benth. at Kew); Mt. Tamalpais, *Jepson*; Big Sur River, Monterey Co., *Jepson* 2583; Big Creek, Santa Lucia Mts., *K. Brandegee* 30e.

Refs.—ESCHSCHOLTZIA CAESPITOSA Benth. Trans. Hort. Soc. ser. 2, 1:408 (1835), type from Cal., *Douglas*; Fedde in Engler, Pflzr. 4^{104}:197, fig. 24^{21} (1909). *E. tenuifolia* Benth. l.c., type from Cal., *Douglas*. *E. incisa* Greene, Pitt. 5:287 (1905), type loc. Soldiers Home, Los Angeles Co., *Hasse* (doubtfully placed here as no spms. seen). Var. RHOMBIPETALA Jepson. *E. rhombipetala* Greene, Bull. Cal. Acad. 1:71 (1885), type loc. "chiefly lower San Joaquin Valley, but also observed by Mrs. Curran in Colusa Co."; Fedde in Engler, Pflzr. 4^{104}:199, fig. 24^{29}. Var. HYPECOIDES Gray, Proc. Am. Acad. 22:272 (1887). *E. hypecoides* Benth. Trans. Hort. Soc. ser. 2, 1:408 (1835), type from Cal., *Douglas*. *E. austinae* Greene, Bull. Cal. Acad. 1:69 (1885), type loc. Butte Co., *R. M. Austin*, 1883. *E. bakeri* Greene, Pitt. 5:284 (1905), type loc. ridge betw. Lakeport and Hopland, Lake Co., *C. F. Baker* 3094; Fedde in Engler, Pflzr. 4^{104}:196, fig. 24^{23}. *E. biternata* Greene l.c. 271, type loc. upper Mad River, Trinity Co., *Blankinship*. *E. cruciata* Greene l.c. 279, type loc. Huron, Fresno Co., *Eastwood*. *E. dolichocarpa* Eastw. Bull. Torr. Club 30:487 (1903), type loc. Pt. Gorda, Santa Lucia Mts., *Plaskett* 84. *E. dumetorum* Greene l.c. 283, type loc. Yolo Mts., *C. F. Baker* 2995; Fedde l.c. fig. 24^{22}. *E. elmeri* Greene l.c. 286, type loc. Tassajara Hot Sprs., Monterey Co., *Elmer* 3268; Fedde l.c. 163, fig. 22^{7}. *E. flaccida* Fedde, Notizbl. Bot. Gart. u. Mus. Berl. 4^{31}:153 (1904), type loc. Loma Prieta, *Dudley*; Fedde in Engler, Pflzr. 4^{104}:195, fig. 24^{19} (1909). *E. formosa* Greene l.c. 288, type loc. Dry Creek betw. Napa and Sonoma cos., *C. F. Baker* 2614; Fedde l.c. 198, fig. 24^{26}; var. *urocalyx* Fedde, Rep. Nov. Sp. 3:184 (1906), type loc. Mt. St. Helena, *C. F. Baker* 2614; Fedde in Engler, Pflzr. 4^{104}:198, fig. 24^{27}. *E. pseudalcicornis* Fedde, Rep. Nov. Sp. 3:184 (1906), type loc. San Jose, *Keating*; Fedde in Engler, Pflzr. 4^{104}:190, fig. 24^{10} (1909). *E. tenuissima* Greene l.c. 285, type loc. Mariposa Co., *Congdon*; Fedde l.c. 197, fig. 24^{25}.

E. CARUIFOLIA Greene, Pitt. 5:281 (1905), type loc. Leesville, Colusa Co., *Brandegee*, Apr. 1889. *E. rostellata* Greene l.c. 282, type loc. Coloma, Eldorado Co., *Rixford*, May 30, 1901. Stems slender, very many from base, 3 to 7 in. high; leaves dissected into very narrow linear segments; petals 4 to 8 lines long. The spms. examined are as quoted above. The status of this form must remain doubtful until further collections are available.

7. **E. glyptosperma** Greene. Glaucous annual with densely tufted nearly equal basal leaves; stems numerous, scapose, slender, rather stiffly erect, usually 3 to 7 inches high, far exceeding the leaves; leaves much dissected into short crowded linear divisions; petals broad, 5 to 7 (or 10) lines long; capsule 1½ to 2 inches long; seeds globose, coarsely pitted and without reticulation, the pits rather distant.

Mohave Desert; east to Utah. May.

Locs.—Kramer, *K. Brandegee*; *Barstow, *K. Brandegee* 24e, 36e, *Jepson* 5357, 5809, 6150; *Daggett, *K. Brandegee* 35e; *Sheephole Mts., *Hall* 6044; Needles, *Ruby Warner*; Santa Maria Mts., *Schellenger*, Apr. 1905.

Refs.—ESCHSCHOLTZIA GLYPTOSPERMA Greene, Bull. Cal. Acad. 1:70 (1885), type loc. Mohave Desert, *Curran*; Fedde in Engler, Pflzr. 4^{104}:202, fig. 24^{24} (1909). *E. paupercula* Greene, Pitt. 5:262 (1905), type loc. Mohave Desert, *N. C. Wilson*.

FUMARIACEAE. FUMITORY FAMILY

Ours glabrous perennial herbs with alternate compound dissected leaves and irregular perfect flowers. Sepals 2, small and scale-like. Petals 4, in 2 dissimilar pairs, the outer larger, inner pair narrower, carinate or crested on the back, cohering by the callous apex and covering the anthers and stigma. Stamens in 2 sets of 3 each, placed opposite the outer petals, the filaments of each set usually united; middle anther of each set 2-celled, the lateral ones 1-celled. Ovary superior. Capsule 1-celled, with 2 parietal rib-like placentae from which the valves separate, or indehiscent.—Genera 5 and species about 225, all continents except South America and Australia.

Bibliog.—Baillon, H., Fumarieae (Nat. Hist. Pl. 3:141–143,—1874). Gray, A., Corydalis aurea and its allies (Bot. Gaz. 11:188–189,—1886). Hutchinson, J., Genera of Fumariaceae and their distribution (Kew Bull. 1921:97–115).

Corolla 2-spurred or 2-saccate at base..........1. DICENTRA.
Corolla 1-spurred at base..........2. CORYDALIS.

1. **DICENTRA** Bernh. DUTCHMAN'S BREECHES

Flowers in racemes or panicles, or solitary. Corolla flattened and cordate at base. Filaments of each set dilated and united, but distinct at the very base and slightly free above.—Species 15, North America and Asia. (Greek dis, twice, and kentron, a spur, some species 2-spurred.)

Stems leafy, tall; flowers yellow, erect; corolla deciduous; petals distinct; crests of the inner petals tubular; seeds crestless.
  Flowers sulphur-yellow; outer petals spreading or recurving to the middle; widely scattered. 1. *D. chrysantha.*
  Flowers straw-yellow or cream-color; outer petals erect or only the tips spreading; seaward South Coast Ranges..........2. *D. ochroleuca.*
Stems naked, scape-like, the leaves all basal; flowers more or less nodding; corolla withering-persistent; sepals persistent or at least not caducous; seeds crested.
  Flowers rose-purple; petals united; crests of inner petals tubular, conspicuous; scapes tall, bearing a cluster of racemes..........3. *D. formosa.*
  Flowers whitish or flesh-color; petals distinct, the outer with narrow recurving tips; crests of inner petals none or obscure; diminutive alpine herbs, the scapes 1 or 2 (or 3)-flowered.
    Recurving tips longer than the body of outer petals..........4. *D. uniflora.*
    Recurving tips shorter than the body of outer petals..........5. *D. pauciflora.*

1. **D. chrysantha** Walp. GOLDEN EAR-DROPS. (Fig. 125.) Glaucous plants with stiff coarse leafy stems 2 to 5 feet high, arising from stout roots; leaves bipinnate, ½ to 1 foot long, the divisions cleft into narrow lobes; flowers yellow, in a large racemose panicle; corolla linear-oblong, only slightly cordate, 6 to 7 lines long; sepals somewhat caducous; outer petals spreading or recurving to the middle, saccate below the tip; crest of inner petals rather narrow, crisped or curly; capsule ¾ to 1¼ inches long.

High dry ridges of the inner ranges: Coast Ranges from Mendocino Co. southward; Sierra Nevada foothills from Calaveras Co. southward; Ventura Co. to San Diego Co. Widely distributed but not common, 1000 to 5350 feet. June.

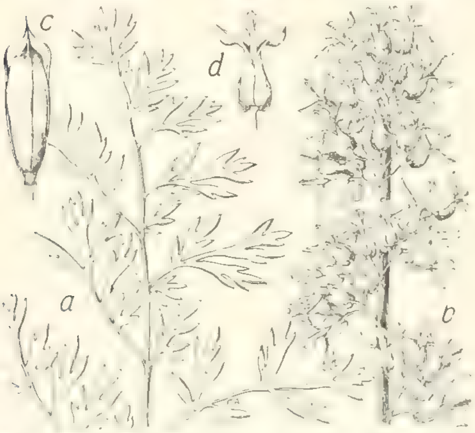

Fig. 125. DICENTRA CHRYSANTHA Walp. *a,* upper portion of leaf, × ½; *b,* inflorescence, × ½; *c,* capsule, × 1; *d,* flower, × 1.

Locs.—Mt. Sanhedrin, *Purpus* 1136; Knoxville grade to Lower Lake, *Jepson;* Miller Cañon, Vaca Mts., *Jepson;* Mt. Diablo, *Jepson;* Alma Soda Spr., Santa Clara Co., *Heller* 7506; Saratoga, *Davy* 389; Ojai Valley, *Olive Thacher;* Watson Spr., North Fork Kaweah River, *Jepson;* Middle Tule River, *Purpus* 5038; Mt. Markham, San Gabriel Mts., *Peirson* 56; San Bernardino, *Jepson* 5564; San Timoteo Cañon, *Jepson* 6083; Chalk Hill, San Jacinto Mts., *Hall* 2630; Palomar, *Hall;* Indian Cañon, Collins Valley, *Jepson* 8843.

Refs.—DICENTRA CHRYSANTHA Walp. Rep. 1:118 (1842). *Dielytra chrysantha* H. & A. Bot. Beech. 320, t. 73 (1840), type from California, *Douglas;* Jepson, Fl. W. Mid. Cal. 210 (1901). *Capnorchis chrysantha* Planch. Fl. Serres, 8:193, t. 820 (1853). *Bikukulla chrysantha* Cov. Contrib. U. S. Nat. Herb. 4:60 (1893).

2. **D. ochroleuca** Engelm. Similar to D. chrysantha, 2 to 3 feet high; panicle consisting of numerous flowers in one or few dense roundish clusters; sepals straw-color or brown, more persistent than in D. chrysantha; flowers pale or somewhat straw-yellow, 7/8 to 1 inch long; outer petals with only the tips spreading, the inner with purple tips and a broad crest.

Santa Inez Mts. to the Santa Monica Mts. Apr.-June.

Locs.—Santa Inez Mts., *Dunn;* Painted Cave Ranch near Santa Barbara, *Eastwood;* Santa Clara Valley, Ventura Co., *Curran;* Santa Monica Mts., *Hasse.*

Refs.—DICENTRA OCHROLEUCA Engelm. Bot. Gaz. 6:223 (1881), type loc. Santa Monica Mts., *Engelmann. Diclytra ochroleuca* Greene, Pitt. 1:187 (1888). *Capnorchis ochroleuca* Greene, Fl. Fr. 279 (1891).

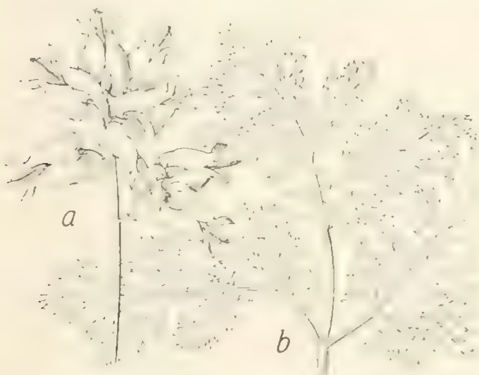

Fig. 126. DICENTRA FORMOSA DC. *a*, inflorescence, × ½; *b*, blade of leaf, × ½.

3. **D. formosa** DC. BLEEDING HEART. (Fig. 126.) Flowering stems naked, scape-like, 8 to 18 inches high, somewhat exceeding the leaves, terminated by a cluster of short racemes; rootstock fleshy and spreading; leaves all basal, on very long petioles, biternately compound, the divisions incisely cleft or pinnatifid; corolla rose-purple (rarely white), ovate-cordate, 7 to 9 lines long, the petals all united to above the middle.

Shady woods, Coast Ranges from Del Norte Co. to Alameda Co.; Sierra Nevada from Shasta Co. to Tulare Co. North to British Columbia. Apr.-June. Sometimes one free filament in each set of the stamens.

Locs.—Coast Ranges, 50 to 1500 feet: Crescent City, *Goddard;* Eureka, *Tracy* 2013; Sherwood, Mendocino Co., *F. Stephens;* Bodega, *Chandler* 669; Olema, *Jepson* 4033. Sierra Nevada, 1500 to 5000 feet: Hatchet Creek, Shasta Co., *Baker & Nutting;* Colby, Butte Co., *R. M. Austin;* Bear Valley, Nevada Co., *Jepson;* Avery Sta., Calaveras Co., *A. L. Grant;* Calaveras Big Trees, *A. L. Grant;* Yankee Hill, Columbia, *A. L. Grant* 673; Pine Ridge, Fresno Co., *Hall & Chandler* 74; Mt. Silliman, *Jepson* 751; Cedar Creek, North Fork Kaweah River, *Hopping;* Mt. Moses, North Fork Middle Tule River, *Purpus* 1345.

Refs.—DICENTRA FORMOSA DC. Syst. 2:109 (1821); Jepson, Fl. W. Mid. Cal. 210 (1901). *Fumaria formosa* Andr. Bot. Rep. 6: pl. 393 (1800), type loc. Nootka, *Menzies;* Sims, Bot. Mag. t. 1335 (1811). *Capnorchis formosa* Ktze. Rev. Gen. Pl. 15 (1891). *Bikukulla formosa* Cov. Contrib. U. S. Nat. Herb. 4:60 (1893).

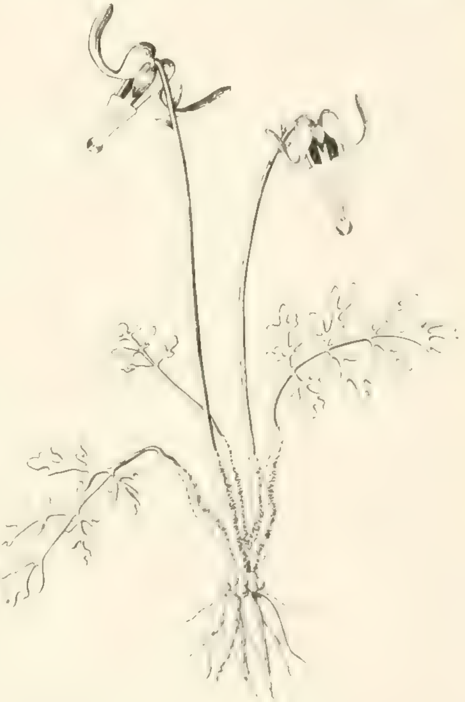

Fig. 127. DICENTRA UNIFLORA Kell.; habit, × 1.

4. **D. uniflora** Kell. STEER'S HEAD. (Fig. 127.) Scapes 1 or 2-flowered, 1 to 3 inches high, arising from a fascicle of tubers; leaves triternately divided into oblong lobes; flowers white or pink; upper portion of outer petals very

narrow, recurving to below the middle; inner petals spoon-shaped at apex, expanded downward, then abruptly truncate and borne by a claw-like base; fruiting scapes prostrate.

Rocky slopes, 6000 to 12,000 feet, Sierra Nevada from Fresno Co. north to Siskiyou Co., thence southerly to Humboldt Co. North to Washington, east to Utah.

Locs.—South Fork Mt., Humboldt Co., *Blasdale;* Trinity Summit, *Davy* 5816; Mt. Bidwell, *Austin & Bruce;* Soupan Sprs., Lassen Peak, *Hall & Babcock* 4298; Truckee, *Sonne;* betw. Angora Peak and Keith's Dome, *Alice M. Ottley* 799; Tilden Lake, *Jepson* 4556; Macomb Ridge, Yosemite Park, *Jepson* 4557; Mt. Dana, *Jepson;* Mt. Lyell, *Jepson* 3331; Nellie Lake, Fresno Co., *A. L. Grant* 1018.

Refs.—DICENTRA UNIFLORA Kell. Proc. Cal. Acad. 4:141, fig. (1871), type loc. Placer Co. (Cisco and Summit); Jepson, Sierra Club Bull. 8:266–269 (1912). *Dielytra uniflora* Greene, Pitt. 1:187 (1888). *Capnorchis uniflora* Ktze., Rev. Gen. Pl. 15 (1891). *Bikukulla uniflora* Howell, Fl. Nw. Am. 34 (1897).

5. **D. pauciflora** Wats. Scapes 4 to 5 inches high, 1 to 3-flowered, arising from fleshy creeping rootstocks; leaves similar to D. uniflora; flowers white or flesh-color, outer petals with saccate spur, the upper portion linear-oblong, 4 lines long, recurving or widely spreading; inner petals narrow or ligulate, abruptly expanded into a spatulate apex, contracted at base and borne on a much dilated or oblong claw as long as the blade proper.

Alpine, 9000 to 10,000 feet, localized in two widely separated regions: Salmon Alps, Scott and Trinity mountains; Sawtooth Range, Tulare Co.

Locs.—Union Lake Valley, Salmon Mts., *Hall* 8623; Mineral King (Contrib. U. S. Nat. Herb. 4:60); Mt. Moses, *Purpus* 1340.

Refs.—DICENTRA PAUCIFLORA Wats. Bot. Cal. 2:429 (1880), based on spms. from Scott Mts., *Greene,* and Castle Lake, Trinity Mts., *Lemmon.* *Dielytra pauciflora* Greene, Pitt. 1:187 (1888). *Bikukulla pauciflora* Cov. Contrib. U. S. Nat. Herb. 4:60 (1893). *Capnorchis pauciflora* Greene, Fl. Fr. 279 (1891).

2. CORYDALIS Vent.

Stems with ample 2 or 3-pinnate leaves. Flowers in racemes. Corolla with only one of the outer petals spurred or gibbous, this becoming posterior by the torsion of the flower; petals all erect and connivent up to the engaged tips of the outer ones. Filaments with nectar-bearing process projecting into the petal-spur. Seeds with a concave aril-like crest.—Species 90, North America, Europe, Asia, Africa. (Greek Korydallis, the ancient name of the crested lark.)

Flowers white or cream-color; spur 1½ to 2 times as long as the petals....................1. *C. caseana.*
Flowers yellow; spur barely ½ as long as the petals....................2. *C. aurea.*

1. **C. caseana** Gray. Stem 1½ to 3 feet high, arising from thickened roots; leaves ½ to 1¼ feet long; leaflets ovate, mucronate, 3 to 9 lines long; raceme dense, 1½ to 3 inches long; corolla white or cream-color, with bluish tips; petals 4 to 5 lines long, the spur nearly straight, 1½ to 2 times as long.

Northern Sierra Nevada from Nevada Co. to Plumas Co., 5000 to 6300 feet.

Locs.—Truckee River, Placer Co., *Sonne;* Indian Valley, Plumas Co., *Lemmon;* Jamison Creek, Plumas Co., *Hall* 9308; Butte Creek, *Hall* 9796; Big Meadows, Plumas Co., *Cleveland;* Morgan, Tehama Co., *Hall & Babcock* 4291.

Refs.—CORYDALIS CASEANA Gray, Proc. Am. Acad. 10:69 (1874), type loc. Big Mdws., Plumas Co., *Lemmon, E. L. Case.* *Capnoides caseanum* Greene, Fl. Fr. 280 (1891). *Corydalis bidwelliae* Wats. Bot. Cal. 2:429 (1880), type loc. Sierra Nevada above Chico, *Annie Bidwell.* *Capnodes bidwellianum* Greene l.c.

2. **C. aurea** Willd. Branching from the base, spreading, about 10 inches high; leaves finely dissected; raceme few-flowered, short, the pedicels 1 to 2 lines long; flowers yellow; petals 3½ to 4 lines long, the spur about half as long; capsules terete, at length torulose, 10 lines long; seeds black, glossy.

Mono Co., 6900 to 7000 feet. Rocky Mts. to Alaska and Nova Scotia.

Loc.—Betw. Pickle Mdws. and Hardy sta., *Alice M. Ottley* 1133.

Refs.—CORYDALIS AUREA Willd. Enum. 740 (1809), type loc. Canada; Gray, Gen. Pl. U. S. 1:124, pl. 52 (1848). *Fumaria aurea* Ker. Bot. Reg. t. 66 (1815). *Capnoides aureum* Ktze. Rev. Gen. Pl. 14 (1891).

JEPSON, FLORA OF CALIFORNIA, vol. 1, pp. 553–578, Jan. 21, 1922.

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